NAVAIR 01-40AVF-1

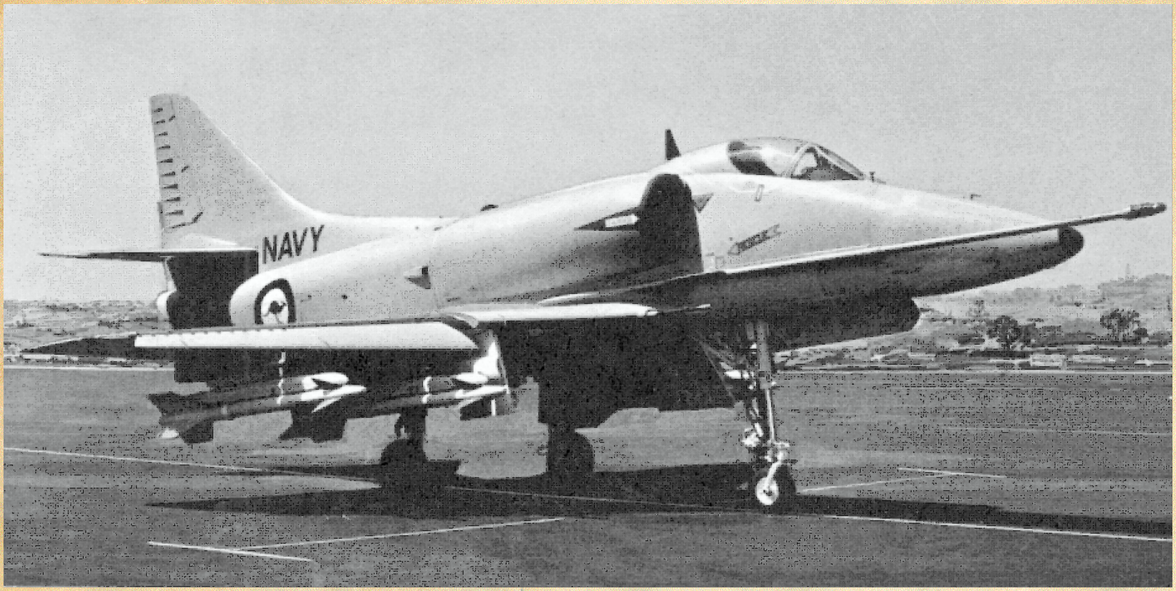
Supplement to NATOPS Flight Manual

NAVY MODEL

A-4E/F International Model A-4G AIRCRAFT

THIS PUBLICATION SUPPLEMENTS NAVAIR 01-40AVC-1 DATED 15 NOVEMBER 1968, CHANGED 15 NOVEMBER 1970, AND SUPERSEDES NAVAIR 01-40AVF-1 DATED 1 MARCH 1968

THIS PUBLICATION IS INCOMPLETE WITHOUT CONFIDENTIAL SUPPLEMENT NAVAIR 01-40AVF-1A, OR A-4/TA-4 TACTICAL MANUAL NAVAIR 01-40AV-1T



ISSUED BY AUTHORITY OF THE CHIEF OF NAVAL OPERATIONS AND UNDER THE DIRECTION OF THE COMMANDER, NAVAL AIR SYSTEMS COMMAND

This PDF is an exact copy of how pages appeared when the manual was in use - specific extra pages have been added for the A-4G and by the RAN Fleet Air Arm also (these pages are at the beginning)

VF-805 & VC-724 Sqdns
Royal Australian Navy
Fleet Air Arm

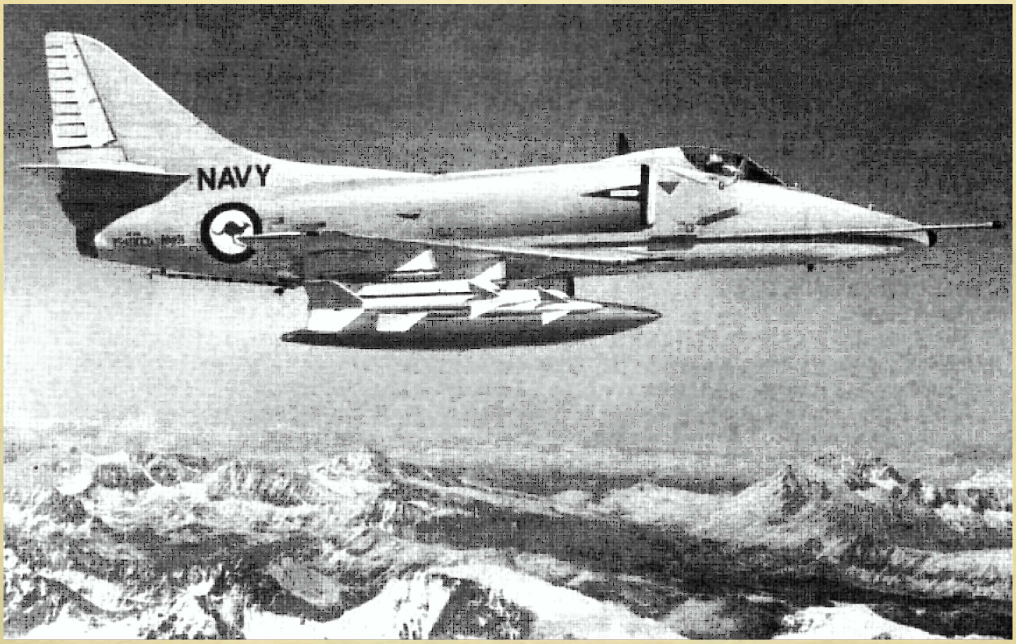
724

NAVAIR 01-40AVC-1

NATOPS
Flight Manual
NAVY MODEL
A-4E/F AIRCRAFT

THIS PUBLICATION CANCELS AND SUPERSEDES NAVAIR 01-40AVC-1 DATED 1 FEBRUARY 1964, CHANGED 1 FEBRUARY 1968 AND NAVAIR 01-40AVE-1 DATED 15 FEBRUARY 1967, CHANGED 1 FEBRUARY 1968.

THIS PUBLICATION IS INCOMPLETE WITHOUT A-4/TA-4 TACTICAL MANUAL (NAVAIR 01-40AV-1T)



ISSUED BY AUTHORITY OF THE CHIEF OF NAVAL OPERATIONS AND UNDER DIRECTION OF THE COMMANDER, NAVAL AIR SYSTEMS COMMAND

The actual 'punch' holes for ring binding of actual manual pages have been retained to also illustrate the 'facing' pages of the manual (with some RAN FAA quirks at beginning

Supplement to NATOPS Flight Manual

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771-1

ISSUED BY AUTHORITY OF THE CHIEF OF NAVAL OPERATIONS AND UNDER THE DIRECTION OF THE COMMANDER, NAVAL AIR SYSTEMS COMMAND

15 June 1971

LIST OF EFFECTIVE PAGES

INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES.

NOTE: The portion of the text affected by the current change is indicated by a vertical line in the outer margins of the page.

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 49, **CONSISTING OF THE FOLLOWING:**

Page No.	*Issue*
Title	15 June 1971
A	15 June 1971
Flyleaf 1	15 June 1971
Flyleaf 2 Blank	15 June 1971
i	15 June 1971
*ii	15 November 1970
iii - v	15 June 1971
*vi	15 July 1969
vii Blank	15 June 1971
1-0	15 June 1971
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1-2 Blank	15 June 1971
1-3	15 June 1971
*1-4	15 November 1968
1-10A Blank	15 June 1971
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1-93	15 June 1971
*1-94	15 November 1968
*3-7	15 November 1970
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*Index 14	15 November 1970
Index 15	15 June 1971
Index 16 Blank	15 June 1971
FO-0	15 June 1971
FO-2	15 June 1971
FO-5	15 June 1971

*Asterisk indicates back-up pages added from basic NATOPS Flight Manual NAVAIR 01-40AVC-1

Figure 1-1. Model A-4G Aircraft

PART 1
GENERAL DESCRIPTION

DESCRIPTION

The Navy Model A-4G Skyhawk (figure 1-1) is a single-place monoplane with a modified delta-planform wing manufactured by the Douglas Aircraft Company, Aircraft Division, Long Beach, California. The aircraft is powered by a P&WA J52-P-8A gas turbine engine producing a sea level static thrust rating of 9300 pounds. Designed as a high performance, lightweight attack aircraft, it mounts two 20mm guns internally, carries a variety of external stores, and is capable of operating from either a carrier or a shore base. The total operating weight of the aircraft is 11, 350 pounds which includes a 180-pound pilot, oil, trapped fuel and oil, liquid oxygen, centerline pylon, gun installation (less ammunition), AWW-1 fusing system, inboard and outboard wing pylons, and two empty 300-gallon external fuel tanks.

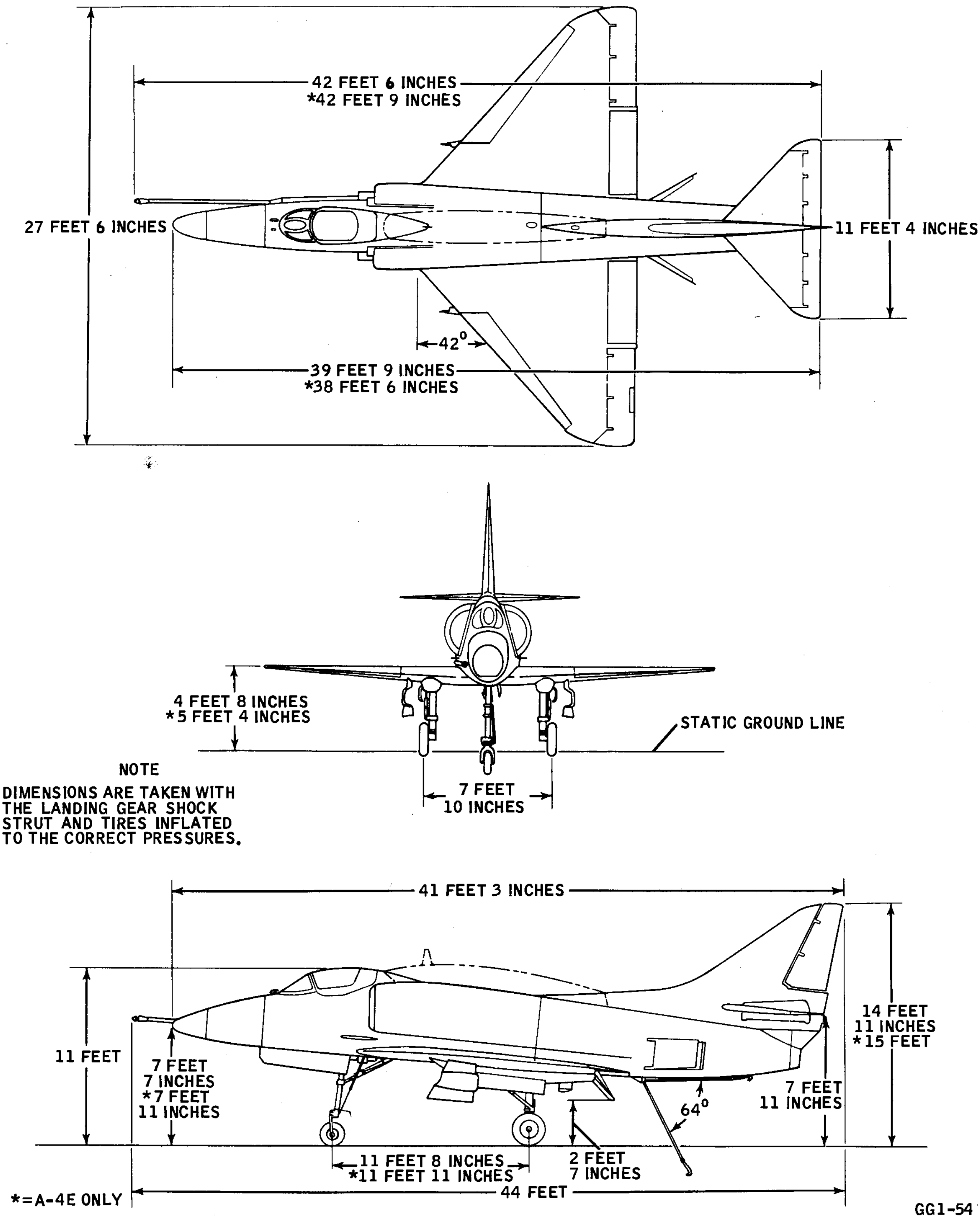

Figure 1-2. Principal Dimensions

Superintendent,
Aircraft Maintenance & Repair,
Sydney.
February, 1973.

Amendment List No.(RAN)5
to
AP(RAN)NA01-40AVC-1

INSTRUCTION SHEET

NATOPS

FLIGHT MANUAL

NAVY MODELS A-4E/F AIRCRAFT

INSERTION OF LEAVES

1. Remove and destroy existing List of Supplements and insert new List of Supplements to AL.5.
2. Insert RAN Supplement number 6 to face page 1-93 Sect.I Part 2.
3. Record incorporation of Amendmendment List in the AL Record Certificate and destroy this Instruction Sheet.

REF: (AS/720/73) 4803

ROYAL AUSTRALIAN NAVY

LIST OF SUPPLEMENTS

Sect/Page Affected	Supplement
Sect.V, Page 5-36	1
Sect.I Pt.4, Page 1-133	2
Sect.I Pt.4, Page 1-131	3
Sect.IV Pt.2, Page 4-22	4
Sect.I Pt.4, Page 1-129	5
Sect.I Pt.2, Page 1-93	6

ROYAL AUSTRALIAN NAVY

SUPPLEMENT No. 6

TO

NA01-40AVC-1, SECTION 1, PART 2, PAGE 1-93

INTRODUCTION

1. This Supplement is promulgated to describe RAN Skyhawk banner towed target pilot operating procedures and flight limitations.

BRIEF DESCRIPTION OF EQUIPMENT

2. The standard 30' x 6' banner is used to provide a suitable air-to-air gunnery target for Skyhawk armament training. The banner is of polythene mesh, and is secured to a spreader bar, fitted with a counterweight on one end to keep the banner in a vertical position whilst airborne. The banner is towed from a specially-designed platform, secured in the same manner as a general store to the Aero 7A centreline rack-pylon. The banner may be electrically released from the platform, or the platform and two explosively jettisoned in an emergency, using the normal armament circuits and switches. The banner is towed behind the aircraft using a specially-manufactured, plastic-sheathed 1200 ft steel cable, and incorporates swivel fittings and a weak link shear pin. Three large nylon webs of 100ft length secure the cable to the banner spreader bar.

OPERATING PROCEDURES

Preflight

3. (a) Ensure towing platform has been fitted to aircraft, and armament pre-flight procedures have been signed for in the TA-100.

   (b) During pre-flight exterior inspection, check security of platform on centreline rack, and platform members and J-hook release unit for obvious damage.

   (c) Calculate takeoff distance as described in para.11 of this Supplement.

Pre-taxi

4. (a) Check all armament switches are safe and off, and select station "3" or or "ALL" on emergency select switch as appropriate for takeoff.

   (b) Check centreline rack safety pin removed with other pins.

Pre-takeoff

5. (a) After banner handling party have streamed banner and towline, and ATC entry clearance received, taxi down centreline with nosewheel slightly to one side of towline to minimise wear on same. Aircraft will be marshalled over towline end. Keep brakes on and engine at idle while towline is connected to platform. Tension-up as directed by marshaller.

YES! — the RAN put the holes on the wrong side of these additional pages

Takeoff

6. (a) Takeoff should be made with takeoff flap set, and using takeoff speed for actual gross weight as listed in NATOPS takeoff charts.

(b) Use standard run-up and brake release procedures; correct any initial nose swing with nosewheel steering and/or differential braking; expect a slightly slower acceleration than with clean aircraft.

(c) Just before calculated takeoff speed, move stick back, and rotate aircraft to lift-off on speed. Immediately adopt a steep climbing attitude (approximately 12-13 deg. nose-up). When comfortably airborne, retract wheels and flaps in normal manner.

NOTE: Takeoff planning data is contained in para 11.

In-flight

7. (a) The aircraft must be operated within the limitations laid down in para 10.

(b) Flight planning and fuel requirements can be calculated using Natops Section XI performance data charts and data contained in para 12 of this Supplement.

(c) Aircraft handling qualities during banner towing operations are unchanged with respect to clean aircraft behaviour, provided the prescribed banner towing limitations are not exceeded. Apparent directional stability is increased. Mild longitudinal vibrations may occur during flight, this phenomena being more apparent during higher speed operations or flight through turbulence. Longitudinal trim data is contained in para 13 of this Supplement.

Normal release operations

8. (a) Obtain drop point and direction from ATC on return from exercise; plan a descending straight in approach, to be at 350 ft AGL and 160 KIAS at drop point. Release will normally be called by Airwatch, and should normally be made in the clean aircraft configuration.

(b) Prior to release, place armament switches in following configuration:-

(1) Function select switch to BOMBS & GM ARM.
(2) Station 3 switch to READY.
(3) Armament master switch to ON.

(c) For release, depress bomb release button.

Emergency release operations

9. (a) If banner fails to release (as indicated by longitudinal vibration and call by Airwatch), plan flight pattern for second release attempt, recycle armament switches as listed in para 8(b), recheck correct switch positions, and attempt further release.

(b) After second release attempt, position aircraft for further attempt and place switches listed in para 8(b) to safe. Place Emergency Selector Switch to No. "3" position.

9. (c) At release point, pull Emergency stores Release Handle. Banner and platform complete should be explosively jettisoned.

(d) If a second attempt at emergency jettison procedure is unsuccessful, fly the aircraft over a clear area out to sea, and increase speed to 450-500 KIAS. Release should be felt as a marked longitudinal vibration when the weak link shear pin fails within this airspeed range.

WARNING: (1) Release of the banner at airfields should only be carried out over ATC-approved and visually clear areas. Releases must be made in straight and level flight with allowance made for cross-winds during period of banner drop.

(2) Transits to and from the coast should be made at a maximum airspeed of 250 KIAS, and over uninhabited areas.

NOTE: Normal release cannot be made after failure of main generator, or during emergency generator operation.

Limitations

10. (a) Maximum speed - 280 KIAS/0.6 IMN

(b) Maximum speed (over land) - 250 KIAS/0.6 IMN

(c) Recommended maximum speed during firing practice - 250 KIAS

(d) Maximum speed for full power climb - 250 KIAS

(e) Maximum speed for speedbrake operations - 250 KIAS

(f) Maximum load factors - +2g/0g

(g) Maximum bank angles (flap up):-
(1) 0 to 10 units AOA - 60^{o}
(2) 10 to 15 units AOA - 45^{o}
(3) 15 to 20 units AOA - 30^{o}

(h) Maximum bank angle (flap down) - 30^{o}

(i) Maximum AOA (wings level) - 20 UNITS

(j) Turn reversals - may be made within roll limits for a given configuration using moderate roll rates.

(k) Maximum takeoff crosswind - 10 kt

(l) Maximum sideslip - 5 deg

(m) Hook use - not to be lowered whilst airborne, except in emergencies.

FLIGHT PLANNING DATA

Takeoff

11. (a) Using Section XI Chart 11-10 **(A-4G) or 11-8 (TA-4G), calculate takeoff** airspeed using actual aircraft gross weight.

11. (b) For aircraft ground roll distance, use given temperature, pressure altitude, headwind and runway gradient figures, but add 1850 lb to actual gross weight for given gross weight.

(c) To aircraft ground roll distance, add 1940 ft (to allow for streamed banner and additional banner ground roll) to obtain total required runway distance to banner liftoff.

NOTE: This assumes banner is streamed at edge of runway downwind threshold.

WARNING: (1) These figures refer to dry runway conditions. Extra drag caused by wet banner and water on runway would increase takeoff distance.

(2) It must be borne in mind that the last 850 ft of runway will be unavailable due to fouling of banner on upwind rigged arresting gear, at NAS Nowra.

Climb, Cruise and Descent

12. For all airborne flight planning data, add a drag index of 160 for banner and associated equipment, to the normal external drag index of the tow aircraft, and utilize performance data charts in Section XI of Natops.

Centre of Gravity

13. (a) Banner platform (39 lb) is fitted at an arm of 228 ins. giving a moment of 8.892 lb in/1000 (i.e. approximate C.G. change of 0.1% MAC forward).

(b) Apparent C.G. change trim effect due to offset banner drag line whilst airborne is as follows:-

@ 160 KIAS - 1 deg. extra noseup trim required.
@ 250 KIAS - ½ deg. extra noseup trim required.

Vertical drop of banner

14. @ 160 KIAS - 120 ft.
@ 250 KIAS - 80 ft.

REFERENCE: AHAFTU FLIGHT TEST REPORT F6/72

S.A.M.R.
SYDNEY.
February, 1973.

SURPLUS

EVT

724

Supplement to NATOPS Flight Manual

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AL(RAN)2, Nov 69

AP(RAN)MA01-40AVC-1
15 Nov 68 Changed
15 August 1970

Royal Australian Navy

List of Supplements

SECTIONS AFFECTED	Supplement No.
Section V, Page 5-36 Horizontal Stabilizer Trim Malfunction Post Mod. Skyhawk/RAN 3	1
Section 1, Pt. 4 Page 1-133 Fig. 1-57 Revised limit markings for oil pressure gauge.	2
Section 1, Pt.4, Page 1-131 Maximum permissable centre of gravity range for the clean aircraft	3
Section IV, Pt.2, Page 4-22 Dump Warning Light, Inflight Refuelling Control Console	4

AMENDMENT RECORD SHEET

To record the incorporation of an Amendment List in this publication, sign against the appropriate AL(RAN) No. and insert the date.

AL(RAN) No.	AMENDED BY	DATE	AL(RAN) No.	Amended By	Date
1			28		
2	[illegible]	25 Aug 71	29		
3			30		
4			31		
5			32		
6			33		
7			34		
8			35		
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DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
WASHINGTON, D.C. -20350

1 March 1968

LETTER OF PROMULGATION

1. The Naval Air Training and Operating Procedures Standardization Program (NATOPS) is a positive approach towards improving combat readiness and achieving a substantial reduction in the aircraft accident rate. Standardization, based on professional knowledge and experience, provides the basis for development of an efficient and sound operational procedure. The standardization program is not planned to stifle individual initiative but rather, to aid the Commanding Officer in increasing his unit's combat potential without reducing his command prestige or responsibility.

2. This manual standardizes ground and flight procedures but does not include tactical doctrine. Compliance with the stipulated manual procedure is mandatory except as authorized herein. In order to remain effective, NATOPS must be dynamic and stimulate rather than suppress individual thinking. Since aviation is a continuing progressive profession, it is both desirable and necessary that new ideas and new techniques be expeditiously evaluated and incorporated if proven to be sound. To this end Type/Fleet/Air Group/Air Wing/Squadron Commanders and subordinates are obligated, authorized and directed to modify procedures contained herein, in accordance with OPNAV Instruction 3510.9 series and applicable directives, for the purpose of assessing new ideas, in a practical way, prior to initiating recommendations for permanent changes. This manual is prepared and kept current by the users in order to achieve maximum readiness and safety in the most efficient and economical manner. Should conflict exist between the training and operating procedures found in this manual and those found in other publications, this manual will govern.

3. Checklists and other pertinent extracts from this publication necessary to normal operations and training should be made and may be carried in Naval Aircraft for use therein. It is forbidden to make copies of this entire publication or major portions thereof without specific authority of the Chief of Naval Operations.

Thomas F. Connolly

THOMAS F. CONNOLLY
Vice Admiral, USN
Deputy Chief of Naval Operations (Air)

INTERIM CHANGE SUMMARY

The following Interim Changes have been canceled or previously incorporated in this manual:

INTERIM CHANGE NUMBER(S)	REMARKS/PURPOSE

The following Interim Changes have been incorporated in this Change/Revision:

INTERIM CHANGE NUMBER	REMARKS/PURPOSE

Interim Changes Outstanding - To be maintained by the custodian of this manual:

INTERIM CHANGE NUMBER	ORIGINATOR/DATE (or DATE/TIME GROUP)	PAGES AFFECTED	REMARKS/PURPOSE

AIRCRAFT CHANGE SUMMARY

The A-4 aircraft have been modified by many field changes which affect operation of the aircraft and equipment. Throughout this manual, field changes are referred to by Aircraft Service Change (ASC) or Airframe Change (AFC) number, one or the other of which is assigned to the required modification. Following is a list of ASC'S/AFC'S that apply to this manual. The change is briefly described and, where applicable, information is given for visual determination of incorporation. Since all ASC'S/AFC'S referred to on this page may not be incorporated into a particular aircraft, the pilot must check with the maintenance department to determine which changes have been installed in the aircraft.

ASC or AFC No.	Description	Visual Identification

AFC No.	Description	Visual Identification
327	Eight-Day Clock	Inst Panel
331	Improved Air Bleed System for Air Turbine Transfer Pump	None
333-1	LAWS, Installation	Wiring Mod.
343-I, -II	Communications Equipment	RH Console
344	Emergency Bomb Release Selector Switch	Armament Panel
345	Warning Light Press-to-Test Circuit	Inst Panel
353	Gunsight Mount Rigidity and Light Dimming Circuit	Inst Panel
356	IFF MODE 4 Failure Light	RH Glareshield
359	Escapac I Zero-Zero Escape System	Cockpit
360-1	Upper Avionics Compartment	LH Glareshield
376	Full Shrike System Early A-4E	Armament Panel
382	Exhaust Smoke Abatement	LH Wedge Console
386	Shrike Improved Display System (SIDS)	Armament Panel
387	Radar Control Console	LH Console
394, -I, -II, -III, -VI	Supplement ECM	Wiring/Control Mod.
395	Improved Walleye Display	Inst Panel
400	J52-P-8A Engine Installation	Cockpit Placard
418-II	AN/ALE Chaff Dispenser	LH Glareshield
423	Disable LAWS Unreliability Tone with APR-27 Installed	Wiring Mod.
428	Instrument Panel Lighting Control	Wiring/Control Mod.
429	Nosewheel Steering	Throttle Quad.
430	Cockpit Landing Checklist Panel	LH Inst Panel
442	Wing Lift Spoilers	Throttle Quad.
451	Gunsight, Adjustment Knob Assembly	Center Glareshield
451-I	Interchange Angle-of-Attack Indexer and Accelerometer	Instrument Panel
456	Angle-of-Attack Indexer	Above Glareshield
464	AXC-666 Air Data Computer Wiring	Wiring Mod.
473	AN/APN-154(V) Radar Beacon	LH Console

TABLE OF CONTENTS

FOREWORD

SCOPE

The NATOPS Flight Manual is issued by the authority of the Chief of Naval Operations and under the direction of Commander, Naval Air Systems Command in conjunction with the Naval Air Training and Operating Procedures Standardization (NATOPS) Program. This manual contains information on all aircraft systems, performance data, and operating procedures required for safe and effective operations. However, it is not a substitute for sound judgement. Compound emergencies, available facilities, adverse weather or terrain, or considerations affecting the lives and property of others may require modification of the procedures contained herein. Read this manual from cover to cover. It's your responsibility to have a complete knowledge of its contents.

APPLICABLE PUBLICATIONS

The following applicable publications complement this manual:

NAVAIR 01-40AVC-1 (basic A-4E/F NATOPS flight manual)

NAVAIR 01-40AVF-1B (checklist)

NAVAIR 01-40AV-1T (tactical manual)

NAVAIR 01-40AV-1T(A) (supplement)

NAVAIR 01-40AV-1TB (tactical pocket guide)

NAVAIR 01-40AVC-1-6 (functional checklist)

HOW TO GET COPIES

Automatic Distribution

To receive future changes and revisions to this manual automatically, a unit must be established on the automatic distribution list maintained by the Naval Air Technical Services Facility (NATSF). To become established on the list or to change distribution requirements, a unit must submit NAVWEPS Form 5605/2 to NATSF, 700 Robbins Ave., Philadelphia, Pa. 19111, listing this manual and all other NAVAIR publications required. For additional instructions refer to BUWEPSINST 5605.4 series and NAVSUP Publication 2002.

Additional Copies

Additional copies of this manual and changes thereto may be procured by submitting Form DD 1348 to NPFC Philadelphia in accordance with NAVSUP Publication 2002, Section VIII, Part C.

UPDATING THE MANUAL

To ensure that the manual contains the latest procedures and information, NATOPS review conferences are held in accordance with OPNAVINST 3510.11 series.

CHANGE RECOMMENDATIONS

Recommended changes to this manual or other NATOPS publications may be submitted by anyone in accordance with OPNAVINST 3510.9 series.

Routine change recommendations are submitted directly to the Model Manager on OPNAV Form 3500-22 shown on the next page. The address of the Model Manager of this aircraft is:

Commanding Officer
VA-127
NAS Lemoore, California 93245
Attn: NATOPS Evaluator

Change recommendations of an URGENT nature (safety of flight, etc.,) should be submitted directly to the NATOPS Advisory Group Member in the chain of command by priority message.

YOUR RESPONSIBILITY

NATOPS Flight Manuals are kept current through an active manual change program. Any corrections,

additions, or constructive suggestions for improvement of its content should be submitted by routine or urgent change recommendation, as appropriate, at once.

NATOPS FLIGHT MANUAL INTERIM CHANGES

Flight Manual Interim Changes are changes or corrections to the NATOPS Flight Manuals promulgated by CNO or NAVAIRSYSCOM. Interim Changes are issued either as printed pages, or as a naval message. The Interim Change Summary page is provided as a record of all interim changes. Upon receipt of a change or revision, the custodian of the manual should check the updated Interim Change Summary to ascertain that all outstanding interim changes have been either incorporated or canceled; those not incorporated shall be recorded as outstanding in the section provided.

CHANGE SYMBOLS

Revised text is indicated by a black vertical line in either margin of the page, adjacent to the affected text, like the one printed next to this paragraph. The change symbol identifies the addition of either new information, a changed procedure, the correction of an error, or a rephrasing of the previous material.

WARNINGS, CAUTIONS, AND NOTES

The following definitions apply to "WARNINGS," "CAUTIONS," and "NOTES" found through the manual.

WARNING

An operating procedure, practice, or condition, etc., which may result in injury or death, if not carefully observed or followed.

CAUTION

An operating procedure, practice, or condition, etc., which, if not strictly observed, may damage equipment.

NOTE

An operating procedure, practice, or condition, etc., which is essential to emphasize.

WORDING

The concept of word usage and intended meaning which has been adhered to in preparing this Manual is as follows:

"Shall" has been used only when application of a procedure is mandatory.

"Should" has been used only when application of a procedure is recommended.

"May" and "need not" have been used only when application of a procedure is optional.

"Will" has been used only to indicate futurity, never to indicate any degree of requirement for application of a procedure.

NATOPS/TACTICAL CHANGE RECOMMENDATION
OPNAV FORM 3500/22 (5-69) 0107-722-2002 DATE

TO BE FILLED IN BY ORIGINATOR AND FORWARDED TO MODEL MANAGER

FROM (originator) | Unit

TO (Model Manager) | Unit

Complete Name of Manual/Checklist	Revision Date	Change Date	Section/Chapter	Page	Paragraph

Recommendation (be specific)

SAMPLE

CHECK IF CONTINUED ON BACK

Justification

Signature	Rank	Title

Address of Unit or Command

TO BE FILLED IN BY MODEL MANAGER *(Return to Originator)*

FROM | DATE

TO

REFERENCE
(a) Your Change Recommendation Dated ____________

☐ Your change recommendation dated ________ is acknowledged. It will be held for action of the review conference planned for ____________ to be held at ____________

☐ Your change recommendation is reclassified URGENT and forwarded for approval to ____________ ____________ by my DTG ____________

/S/ ____________ MODEL MANAGER ____________ AIRCRAFT

ROYAL AUSTRALIAN NAVY

SUPPLEMENT No. 7

TO

AP(RAN)NA01-40AVC-1 SEC.1 PT.2

MINIPAN RECONNAISSANCE CAMERA.

CAMERA DESCRIPTION

1. The Perkin Elmer Model 2-18 Minipan aerial reconnaissance camera is a compact, lightweight, 35 mm panoramic camera producing four frames of 6.12in. length each second. It can be used in the Skyhawk installation in either fore and aft (longitudinal) or spanwise (lateral) modes. High shutter speeds are made possible by use of continuously moving film with a rotating inclined mirror and lens system. The scanning slit located near the film plane is coupled to the rotating mirror and moves across the film plane in the opposite direction to film motion. The electrical drive motor is coupled mechanically to a capstan assembly and take-up assembly by mylar belts. The capstan assembly is coupled to the scanning assembly in the same manner; this method of transmission compensates for variations in speed due to slippage such that the photography is not degraded.

2. Leading particulars are:-

Lens	:	50 mm, F/2.3, 2in focal length
Scan Angle	:	$34^{\circ} \times 180^{\circ}$
Frame Rate	:	4 frames per sec., fixed
Picture Size	:	6.12in. x 1.12in. with 0.25in. between frames
Resolution	:	Minimum 75 lines/mm on axis, using 1/1500 sec. at f.2.8 on 3400 Panatomic X film developed for 5 min. in D19 developer at 68°F.
Shutter Speeds	:	1/500, 1/750, 1/1000, 1/1500, 1/2000, 1/3000, 1/4000 sec. (Manual preset)
Aperture	:	F 2.3, 2.8, 4.0, 5.6, 8.0, 11.0, 16.0, 22.0 (Iris control, manual preset)
Film Capacity	:	100ft. standard base daylight film. 240ft. thin base daylight film. (Based on Kodak No.10 spool)
Size	:	8.5 x 8.84 x 7.81ins.
Weight	:	11lb. (Film and window fitted)
Power Requirement	:	28 Volt D.C. 30 Watts

CAMERA INSTALLATION

3. The camera is fitted to a modified aft engine bay access door, with the window and lower section protruding through the door cut-out. Electrical power for the camera is taken from the 28 v.d.c. JATO firing circuit.

CONTROLS AND INDICATORS

4. Control of the camera is via two switches and an associated indicator light.

5. A switch labelled MINIPAN MASTER is located on the JATO control box, outboard of the throttle quadrant. This switch applies 28 volt d.c. power to the camera circuit when selected to the 'on' position. Indication that power is supplied to the circuit is provided by an amber light, MINIPAN READY, mounted adjacent to the MINIPAN MASTER switch. The light illuminates when power is applied to the circuit.

6. The operating pushbutton is mounted on the throttle lever below the handgrip. This button is springloaded to the off position and the camera runs when the button is depressed.

7. Operating Procedures Refer to A4/TA4 TACTICAL MANUAL, NAVAIR 01-40AV-IT for camera operating procedures.

CAUTION

8. At temperatures above 90^{o}F, film starts to deteriorate. If a possibility exists that the temperature in the engine bay will exceed 90^{o}F for extended periods, the camera should be removed to a cooler environment.

9. It is possible for the camera window to be obscured by smears of oil and hydraulic fluid, and the camera may ingest these fluids causing damage to the camera and degradation of the film. Before operating aircraft fitted with Minipan, the aft engine compartment and underside of the fuselage ahead of the camera should be checked as having been thoroughly cleaned and that no excess fluid is present.

S.A.M.R.
SYDNEY.
May, 1973.

ROYAL AUSTRALIAN NAVY

SUPPLEMENT No. 5

To

NA01-40AVC-1, SECTION 1, PART 4, PAGE 1-129

INTRODUCTION

1. This supplement specifies the procedures to be adopted when catapult launching Skyhawk aircraft fitted with external fuel tanks.

REQUIREMENT

2. As it is possible that loss of control may result from catapult launching Skyhawk aircraft with partially filled external fuel tanks this method of varying aircraft launch weight is not to be used.

If external fuel tanks are carried they are either to be full and unpressurised or empty. If aircraft launch weight has to be varied when carrying external fuel, internal fuel tanks are to be partially filled.

NOTE

THIS SUPPLEMENT SUPERSEDES SKYHAWK S.F.I. 1/70

(N.O.L. 1362/1/72 5th MAY '72 refers)

.A.M.R.
YDNEY
GUST 1972

ROYAL AUSTRALIAN NAVY

SUPPLEMENT No.8

TO

NA01-40AVC-1, SECTION 3, PAGE 3-22Q, PARA.V

INTRODUCTION

1. This supplement deletes the requirement for timing the engine run down.

REQUIREMENT

2. Para.V after landing, of Page 3-22Q, delete sub-paragraph A.4 in its entirety.

S.A.M.R.
SYDNEY.
July 1973.

ROYAL AUSTRALIAN NAVY

SUPPLEMENT No.9

TO

NA01-40AVC-1, SECTION 3, PAGE 3-19, ITEM 12

INTRODUCTION

1. This supplement deletes the requirement for timing the engine rundown.

REQUIREMENT

2. Item 12 of Page 3-19 delete "Time Engine Rundown".

S.A.M.R.
SYDNEY.
July, 1973.

SECTION I
THE AIRCRAFT

TABLE OF CONTENTS

KEY TO FIGURE 1-4

1. Air refueling probe
2. Radome
3. Pitot tube
4. Total temperature sensor
5. Brake fluid level window
6. Thermal radiation closure
7. AN/ARC-51A (UHF) radio antenna
8. ECM pod
9. Normal cockpit entry handle
10. External canopy-jettison handle
11. Approach lights
12. Catapult hook
13. External power receptacle and access door
14. Oil tank pressure fillercap
15. Taxi light
16. Angle-of-attack vane and transducer
17. TACAN (V) antenna
18. Static orifice
19. AN/ARA-50 (UHF-ADF) antenna cover
20. Nose compartment access door
21. Oil tank
22. Fuselage fuel tank filler cap
23. Cockpit canopy air bungee cylinder
24. Nose section electronic equipment compartment
25. AN/APG-53B radar transmitter and receiver group
26. Emergency generator
27. Fuselage fuel tank
28. Air refueling probe light
29. Catapult hook
30. Wing tank filler cap
31. Slat
32. Barricade engagement detent
33. Vortex generators
34. Integral wing fuel tank
35. Arresting hook
36. JATO igniter terminal
37. JATO mounting hooks
38. Speedbrake

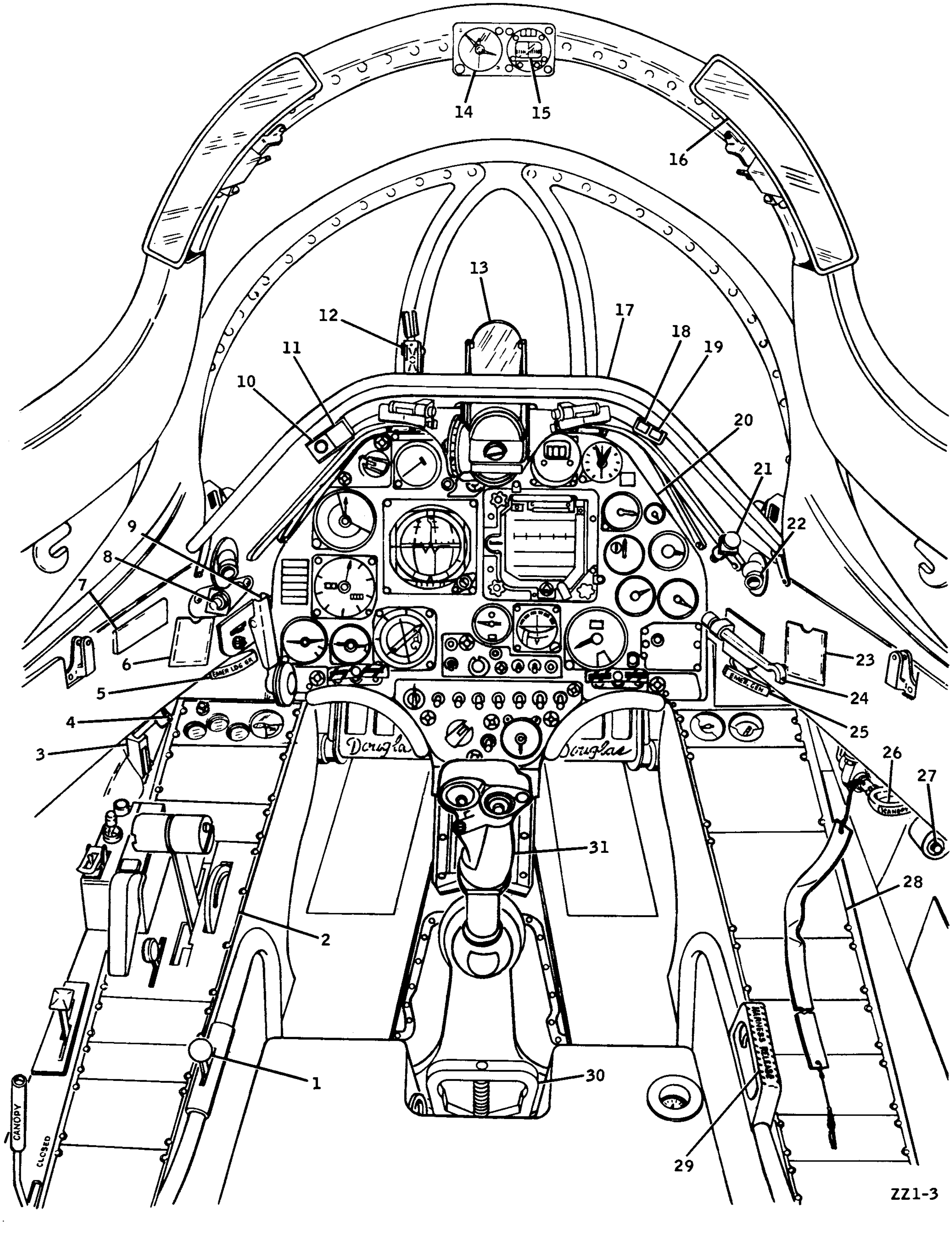
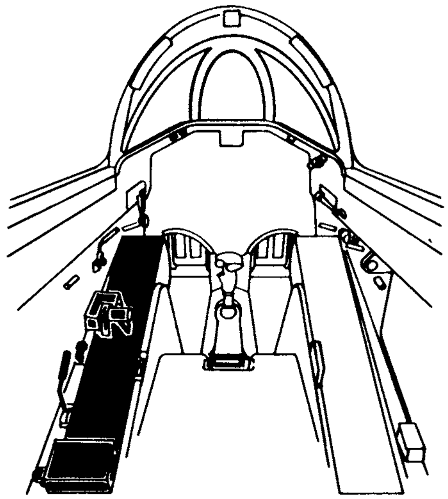
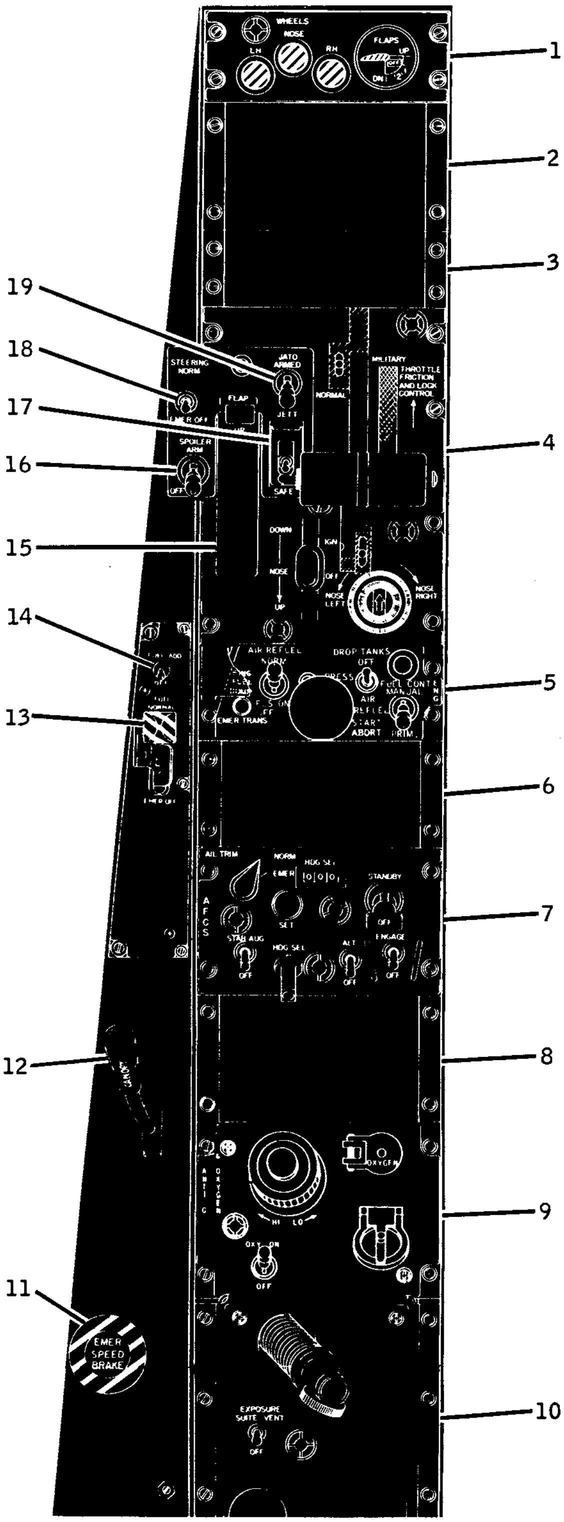


Figure 1-5. General Arrangement – Cockpit

KEY TO FIGURE 1-5

1. Shoulder harness control handle
2. Left console (figure 1-6)
3. Catapult handgrip
4. JATO firing button
5. Emergency landing gear release handle
6. Compass correction card
7. Compass deviation card
8. Rain repellent button
9. Landing gear handle
10. Low altitude warning system light (LAWS)
11. WHEELS warning light
12. Angle-of -attack indexer
13. Gunsight
14. Elapsed-time clock
15. Standby compass
16. Rear view mirror
17. Glareshield
18. FIRE warning light
19. OBST warning light
20. Instrument panel (figure 1-7)
21. Utility floodlight
22. Eyeball diffuser
23. Standby compass deviation card
24. Arresting hook handle
25. Emergency generator release handle
26. Canopy jettison handle
27. White floodlights control
28. Right console (figure 1-8)
29. Harness release handle
30. Alternate ejection handle
31. Control stick





1. WHEELS AND FLAPS POSITION INDICATOR PANEL
2. BLANK PANEL
3. BLANK PANEL
4. THROTTLE PANEL
5. ENGINE CONTROL PANEL
6. BLANK PANEL
7. AUTOPILOT CONTROL PANEL
8. BLANK PANEL
9. OXYGEN AND ANTI-G PANEL
10. ANTI-EXPOSURE SUIT CONTROL PANEL
11. EMERGENCY SPEEDBRAKE CONTROL
12. CANOPY CONTROL HANDLE
13. MANUAL FUEL SHUTOFF CONTROL LEVER
14. SMOKE ABATEMENT SWITCH
15. FLAP HANDLE
16. SPOILER ARM SWITCH
17. JATO JETTISON SWITCH
18. NOSEWHEEL STEERING SWITCH
19. JATO ARM SWITCH

HH1-9-A

Figure 1-6. Cockpit—Typical Left Console

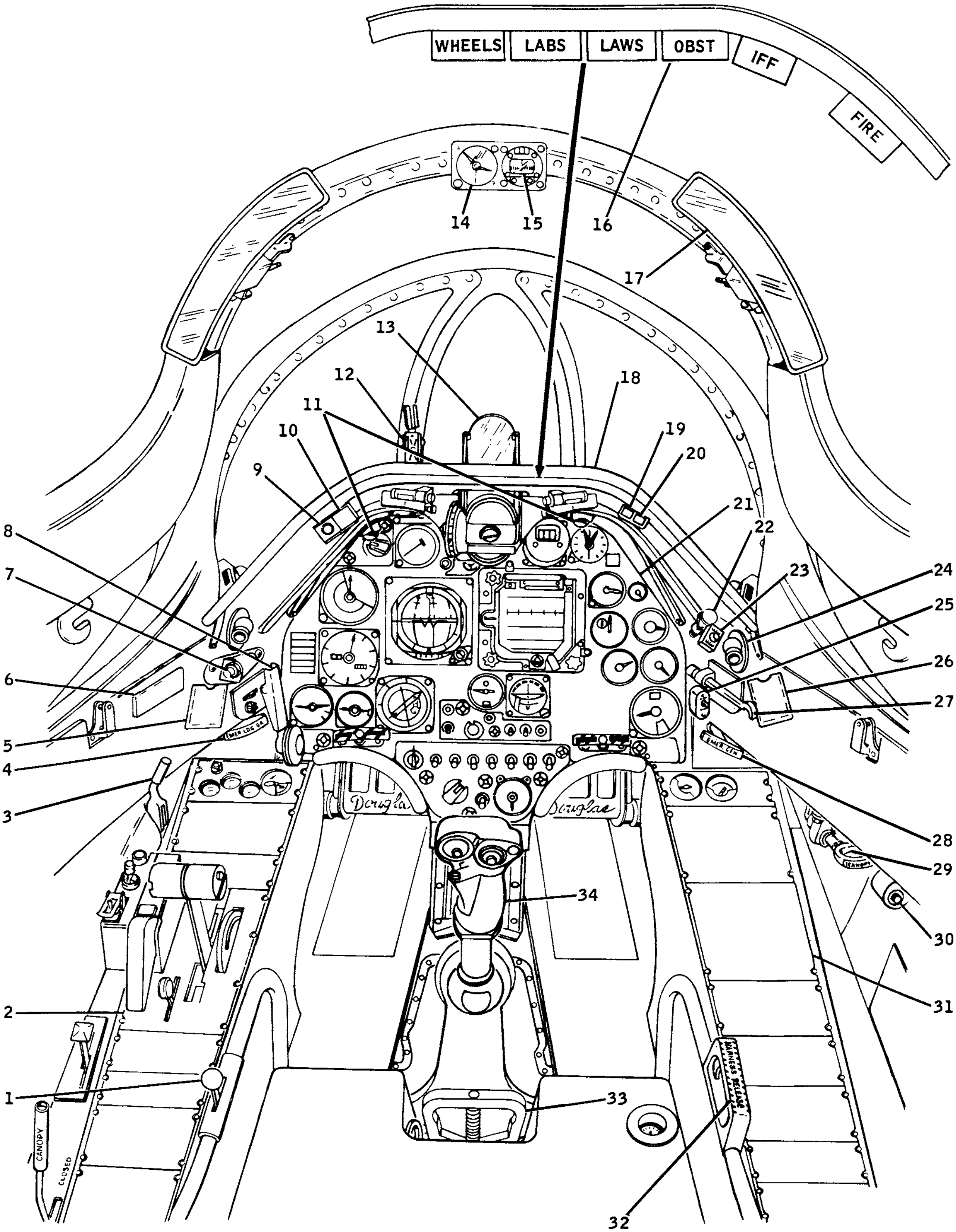


Figure 1-6. General Arrangement — Cockpit

KEY TO FIGURE 1-6

1. Shoulder harness control handle
2. Left console (figure FO-2)
3. Catapult handgrip
4. Emergency landing gear release handle
5. Compass correction card
6. Airspeed correction card
7. Rain repellent button
8. Landing gear handle
9. Low altitude warning system light (LAWS)
10. WHEELS warning light
11. Instrument panel floodlight
12. Angle-of-attack indexer
13. Gunsight
14. Elapsed-time clock
15. Standby compass
16. Glareshield warning lights: WHEELS, *LABS, LAWS, OBST, *IFF, and FIRE (BuNo. 155051, 155052, 155055, 155060-155063, and 155069)
17. Rear view mirror
18. Glareshield
19. FIRE warning light
20. OBST warning light
21. Instrument panel (figure FO-2)
22. Utility floodlight
23. NORMAL, COMBAT lighting control switch
24. Eyeball diffuser
25. AUDIO BYPASS switch
26. Standby compass deviation card
27. Arresting hook handle
28. Emergency generator release handle
29. Canopy jettison handle
30. White floodlights control
31. Right console (figure FO-2)
32. Harness release handle
33. Alternate ejection handle
34. Control stick

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*Inoperative; press-to-test only.

	A-4E	A-4F	TA-4F	A-4G	TA-4G	TA-4J	A-4K	TA-4K
Engine	J52-P-6A J52-P-8A	J52-P-8A	J52-P-6A J52-P-8A	J52-P-8A	J52-P-8A	J52-P-6A	J52-P-8A	J52-P-8A
Thrust	8,500# 9,300#	9,300#	8,500# 9,300#	9,300#	9,300#	8,500#	9,300#	9,300#
Fuselage Fueling Probe Air Refueling Store Intake Ducts	 Yes Yes Separated	 Yes Yes Separated	 Yes Yes Separated	 Yes Yes Separated	 Yes Yes Separated	 Yes Yes Separated	 Yes Yes Separated	 Yes Yes Separated
Upper Avionics Compartment	Some	Yes	No	No	No	No	Yes	No
AFCS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Radar	AN/APG-53A AN/APG-53B	AN/APG-53A AN/APG-53B	AN/APG-53A AN/APG-53B	AN/APG-53A	AN/APG-53A	AN/APG-53A	AN/APG-53A	AN/APG-53A
Video IP-936/AXQ	Some	Some	Some	No	No	No	No	No
Navigation Computer	ASN-19A (Early A-4E) ASN-41	ASN-41	ASN-41	ASN-41	ASN-41	ASN-41	ASN-41	ASN-41
LABS	AN/AJB-3 AN/AJB-3A	AN/AJB-3A	AN/AJB-3A	No	No	No	No	No
CP-741/A	Yes	Yes	Yes	*Yes	No	No	No	No
Oxygen System	10 Liter	10 Liter	10 Liter	10 Liter	10 Liter	10 Liter	10 Liter	10 Liter
Fuel Gaging Fuselage Wing Drop Tanks	 1 Probe 6 Probe Yes	 1 Probe 6 Probe Yes	 1 Probe 6 Probe Yes	 1 Probe 6 Probe Yes	 1 Probe 6 Probe Yes	 1 Probe 6 Probe Yes	 1 Probe 6 Probe Yes	 1 Probe 6 Probe Yes
Fuselage Fuel Cell Capacity	1600 Lb	1600 Lb	700 Lb	1600 Lb	700 Lb	700 Lb	1600 Lb	700 Lb
Elevator Powered	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Aileron Powered	Tandem	Tandem	Tandem	Tandem	Tandem	Tandem	Tandem	Tandem
Stabilizer Trim 12 1/4-Degrees Noseup 1-Degree Nosedown	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bomb Racks	5	5	5	5	5	5	5	5
Rocket Ejection Seat	Escapac 1 Stencel Mod	Escapac 1C-3	Escapac 1C-3	Escapac 1C-3	Escapac 1C-3	Escapac 1C-3	Escapac 1C-3	Escapac 1C-3
Nosewheel Steering	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Spoilers	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Drag Chute	No	No	No	No	No	No	Yes	Yes
Communications	AN/ARC-27A	AN/ARC-51A AN/ARR-69	AN/ARC-51A AN/ARR-69	AN/ARC-51A AN/ARR-69	AN/ARC-51A AN/ARR-69	AN/ARC-51A AN/ARR-69	AN/ARC-51A AN/ARC-115 (VHF) AN/ARR-69	AN/ARC-51A AN/ARC-115 (VHF) AN/ARR-69
Radar Identification (IFF)	APX-6B	APX-64(V)	APX-64(V)	APX-64(V)	APX-64(V)	APX-64(V)	APX-72(V)	APX-72(V)
APC ASN-54	Yes	Yes	Yes	No	No	Provisions Only	No	No
Doppler APN-153(V)	Some	Yes	Yes	*Yes	Yes	Yes	Yes	Yes
TACAN	ARN-21B (Early A-4E) ARN-52(V)	ARN-52(V)	ARN-52(V)	ARN-52(V)	ARN-52(V)	ARN-52(V)	ARN-52(V)	ARN-52(V)
ADF	ARA-25	ARA-50	ARA-50	ARA-50	ARA-50	ARA-50	ARA-50	ARA-50

*BuNo. 155051, 155052, 155055, 155060-155063, and 155069

Figure 1-7. Main Differences

altitude of 1000 feet. On the left of the center of the instrument is a window containing two rotating counters; the inner counter registers altitude in thousands of feet, while the outer registers in ten thousands of feet. When the altimeter pointer makes 12 revolutions, for instance, the outer counter will indicate 1, and the inner counter will indicate 2, thus showing that the aircraft is at an altitude of 12, 000 feet above sea level. Barometric pressure setting, in millibars, is displayed in a window on the right side of the altimeter face. The knob on the lower left corner of the instrument case is used to correct for variations in sea level barometric pressure.

Radar Altimeter

The AN/APN-141 radar altimeter (figure FO-2) employs the pulse radar technique to furnish accurate instantaneous altitude information to the pilot from 0 to 5000 feet terrain clearance. Aircraft height is determined by measuring the elapsed transit time of a radar pulse, which is converted directly to altitude in feet and displayed on the cockpit indicator. The indicator dial face is marked in 10-foot increments up to 200 feet, 50-foot increments from 200 to 600 feet, 100-foot increments from 600 to 2000 feet, and 500-foot increments from 2000 to 5000 feet. A control knob on the front of the indicator controls power to the indicator and is used for setting the low-limit indexer. The control knob also provides for preflight and in-flight test of the equipment with a push-to-test type control knob feature. Refer to LOW ALTITUDE WARNING SYSTEM (LAWS) for information regarding low limit indexer. An OFF flag on the indicator face appears when signal strength becomes inadequate to provide reliable altitude information, when power to the system is lost, or when the system is turned OFF.

CAUTION

Leave the AN/APN-141 radar altimeter in the OFF position until power is applied to the aircraft and return equipment to OFF before power is removed.

NOTE

At altitudes above 5000 feet terrain clearance, the OFF flag will appear and the pointer will move behind the masked portion of the indicator dial. The pointer will resume normal operation when the aircraft descends below 5000 feet.

The radar altimeter operates normally during 50-degree angles of climb or dive and 30-degree angles of bank, right or left. Beyond these points, the indications on the radar altimeter become unreliable but will resume normal operation when the aircraft returns to normal flight.

Low Altitude Warning System (LAWS)

The low altitude warning system is used to warn the pilot of impending danger due to low altitude. The warning system consists of two warning lights and an aural warning tone heard in the pilot's headset that operates in conjunction with the AN/APN-141 radar altimeter. One warning light is located under the glareshield (figure 1-6), and the other, which is the radar low limit warning light, is located adjacent to the radar altimeter (figure FO-2). When the AN/APN-141 radar altimeter indicator pointer drops below the preset low-limit indexer altitude setting, both warning lights come on and the aural warning tone is activated for 2 seconds. The warning tone is an alternating 700- to 1700-cps tone with a repetition rate of 2 cps. In addition, a reliability warning signal sounds for 2 seconds when the radar altimeter acquires or loses its lock-on. The reliability warning signal has the same frequency range but a repetition rate of 8 cps.

AN/AJB-3A All-Attitude Indicator

An all-attitude indicator for the AN/AJB-3A system is located on the instrument panel (figure FO-2). The indicator provides the pilot with a pictorial presentation of the aircraft's pitch, roll, heading, and turn-and-slip. Aircraft attitude reference signals are supplied to the indicator by electrical connection with the remote mounted master reference platform. Pitch, roll, and heading are shown by the orientation of the all-attitude sphere with the miniature reference aircraft attached to the instrument face. A bank inclinometer and an electrically powered rate-of-turn pointer located below the sphere complete the indicator presentation. The horizon is shown as a white line dividing the top and bottom halves of the sphere. The upper half, symbolizing sky, is indicated by a light grey area above the horizon line; the lower half, symbolizing earth, is indicated by a dull black area below the horizon line. The sphere is graduated every 5 degrees in azimuth on the horizon line and every 30 degrees in azimuth in the upper and lower portions of the sphere. The sphere is graduated every 10 degrees of climb and dive. The sphere is free to move a full 360 degrees in pitch, roll, or heading without obstruction. Roll indices are located on the top and bottom of the indicator.

A vertical displacement pointer, vertical and horizontal director pointers, vertical and horizontal director warning flags, and a vertical displacement warning flag are incorporated in the instrument but are not used. All flags and pointers are biased out

of sight at the end of the 60-second start period. The OFF flag disappears at the end of the 60-second start period and should not reappear until the system is turned off. Appearance of the OFF flag after the 60-second start period indicates a power failure in the system. A maximum of 90 seconds may be required for gyro erection and amplifier warmup.

WARNING

- Do not rely on indicator, including rate-of-turn pointer, if OFF flag is visible.
- It is possible to receive erroneous indications on gyro indicator without OFF flag showing.

The turn-and-slip indicators are located below the sphere and are an integral part of the all-attitude indicator. A one-needle width deflection of the turn indicator will result in a standard rate, 2-minute, 360-degree turn. Full deflection (two-needle widths) results in a 1-minute, 360-degree turn. The turn indicator is electrically driven and will operate on emergency generator.

A pitch trim knob, located on the lower right corner of the indicator, with an index mark at its 10 o'clock position, controls the sphere pitch setting in relation to the reference aircraft. Adjustment can be made from 10 degrees noseup to 5 degrees nosedown. The indicator is calibrated to display, at any pitch angle, the true aircraft attitude (Armament Datum Line) in relation to the surface of the earth, with pitch trim knob aligned to the index mark. It is recommended that the pitch trim knob always be aligned to the index mark before flight and be left in that position throughout the flight. This will enable the pilot to always know his true attitude in relation to the surface of the earth regardless of the maneuver performed.

LIQUID OXYGEN DURATION

10 LITER SYSTEM

DATA AS OF: 1 February 1962
DATA BASIS: Specification MIL-I-19326(Wep)

CABIN PRESSURE ALTITUDE -FEET-	HOURS REMAINING					
	GAGE READING (LITERS)					
	10	8	6	4	2	1
40,000 UP	60.6	48.5	36.4	24.2	12.0	4.8
35,000	37.0	29.6	22.2	14.8	7.4	3.6
30,000	27.2	21.8	16.4	10.8	5.4	2.8
25,000	20.4	16.4	12.4	8.2	4.0	2.0
20,000	16.0	12.8	9.6	6.4	3.2	1.6
15,000	12.8	10.2	7.6	5.2	2.6	1.2
10,000	10.0	8.0	6.0	4.0	2.0	1.0
5,000	8.4	6.6	5.0	3.2	1.6	0.8
SEA LEVEL	7.0	5.6	4.2	2.8	1.4	0.6

REMARKS:

(1) Based on 800 liters of gaseous oxygen per liter of liquid oxygen.

(2) Data assume the use of a properly fitted mask.

HH1-22

Figure 1-16. Liquid Oxygen Duration

DURING FLIGHT

Oxygen quantity should be checked periodically during flight.

NOTE

Separation of the oxygen hose couplings will be immediately apparent as oxygen flow and radio communication will cease.

FLIGHT INSTRUMENTS

The airspeed indicator, vertical speed indicator, and altimeter are connected to the pitot-static system. The attitude gyro, standby attitude gyro, bearing-distance-heading indicator (BDHI), angle-of-attack-system, and radar altimeter are electrically operated. The eight-day clock and accelerometer are independent of other systems in operation.

AIRSPEED INDICATOR

A combination airspeed indicator and Mach meter (figure 1-7) is located on the instrument panel. The airspeed portion of the dial is fixed in position, and is calibrated from 80 to 650 knots. The Mach meter scale is a rotating disc, marked from 0.50 to 2.9, turning beneath the airspeed dial. Only a portion of the disc can be seen through a cutout in the airspeed dial. Airspeed and corresponding Mach number are indicated simultaneously by a single needle pointer. On the Mach number disc is a movable index which is used to set a Mach reference by depressing and turning a set knob on the lower left corner of the instrument case. On the edge of the airspeed dial is an airspeed index pointer, which is adjustable through a range of 80 to 145 knots merely by turning the set knob.

VERTICAL SPEED INDICATOR

A vertical speed indicator (figure 1-7) is located on the instrument panel. The indicator shows the rate of ascent or descent of the aircraft. The upper half of the indicator face is graduated in 500-foot units from 0 to 6000 feet with 100-foot scale divisions from 0 to 1000 feet. The upper half of the instrument indicates rate of climb in thousands of feet per minute. The lower half of the indicator face is identical to the upper half except that it indicates rate of descent. The vertical speed indicator is connected to the static pressure system of the aircraft and measures the change in atmospheric pressure as the aircraft climbs or descends.

ALTIMETER

The pressure altimeter (figure 1-7) indicates the altitude of the aircraft above sea level to a height of

50,000 feet. The dial face is marked in increments of 11 feet; each complete revolution of the pointer indicates a change in altitude of 1000 feet. On the left of the center of the instrument is a window containing two rotating counters; the inner counter registers altitude in thousands of feet, while the outer registers in ten thousands of feet. When the altimeter pointer makes 12 revolutions, for instance, the outer counter will indicate 1, and the inner counter will indicate 2, thus showing that the aircraft is at an altitude of 12,000 feet above sea level. Barometric pressure setting, in millibars, is displayed in a window on the right side of the altimeter face. The knob on the lower left corner of the instrument case is used to correct for variations in sea level barometric pressure.

RADAR ALTIMETER

The AN/APN-141 radar altimeter (figure 1-7) employs the pulse radar technique to furnish accurate instantaneous altitude information to the pilot from 0 to 5000 feet terrain clearance. Aircraft height is determined by measuring the elapsed transit time of a radar pulse, which is converted directly to altitude in feet and displayed on the cockpit indicator. The indicator dial face is marked in 10-foot increments up to 200 feet, 50-foot increments from 200 to 600 feet, 100-foot increments from 600 to 2000 feet, and 500-foot increments from 2000 to 5000 feet. A control knob on the front of the indicator controls power to the indicator and is used for setting the low-limit indexer. The control knob also provides for preflight and in-flight test of the equipment with a push-to-test type control knob feature. Refer to LOW ALTITUDE WARNING SYSTEM (LAWS) for information regarding low limit indexer. An OFF flag on the indicator face appears when signal strength becomes inadequate to provide reliable altitude information, when power to the system is lost, or when the system is turned OFF.

CAUTION

Leave the AN/APN-141 radar altimeter in the OFF position until power is applied to the aircraft and return equipment to OFF before power is removed.

NOTE

At altitudes above 5000 feet terrain clearance, the OFF flag will appear and the pointer will move behind the masked portion of the indicator dial. The pointer will resume normal operation when the aircraft descends below 5000 feet.

The radar altimeter operates normally during 50-degree angles of climb or dive and 30-degree angles of bank, right or left. Beyond these points, the indications on the radar altimeter become unreliable but will resume normal operation when the aircraft returns to normal flight.

LOW ALTITUDE WARNING SYSTEM (LAWS)

The low altitude warning system is used to warn the pilot of impending danger due to low altitude. The warning system consists of two warning lights and an aural warning tone heard in the pilot's headset that operates in conjunction with the AN/APN-141 radar altimeter. One warning light is located under the left side of the glareshield (figure 1-5), and the other, which is the radar low limit warning light,is located adjacent to the radar altimeter (figure 1-7). When the AN/APN-141 radar altimeter indicator needle drops below the preset low-limit indexer altitude setting, both warning lights come on and the aural warning tone is activated for 2 seconds. The warning tone is an alternating 700- to 1700-cps tone with a repetition rate of 2 cps. In addition, a reliability warning signal sounds for 2 seconds when the radar altimeter acquires or loses its lock-on. The reliability warning signal has the same frequency range but a repetition rate of 8 cps.

AN/AJB-3A ALL-ATTITUDE INDICATOR

An all-attitude indicator for the AN/AJB-3A system is located on the instrument panel (figure 1-7). The indicator provides the pilot with a pictorial presentation of the aircraft's pitch, roll, heading, and turn-and-slip. Aircraft attitude reference signals are supplied to the indicator by electrical connection with the remote mounted master reference platform. Pitch, roll, and heading are shown by the orientation of the all-attitude sphere with the miniature reference aircraft attached to the instrument face. A bank inclinometer and an electrically powered rate-of-burn pointer located below the sphere complete the indicator presentation. The horizon is shown as a white line dividing the top and bottom halves of the sphere. The upper half, symbolizing sky, is indicated by a light grey area above the horizon line; the lower half, symbolizing earth, is indicated by a dull black area below the horizon line. The sphere is graduated every 5 degrees in azimuth on the horizon line and every 30 degrees in azimuth in the upper and lower

portions of the sphere. The sphere is graduated every 10 degrees of climb and dive. The sphere is free to move a full 360 degrees in pitch, roll, or heading without obstruction. Roll indices are located on the top and bottom of the indicator.

A vertical displacement pointer, vertical and horizontal director pointers, vertical and horizontal director warning flags, and a vertical displacement warning flag are incorporated in the instrument but are not used. All flags and pointers are biased out of sight at the end of the 60-second start period. The OFF flag disappears at the end of the 60-second start period and should not reappear until the system is turned off. Appearance of the OFF flag after the 60-second start period indicates a power failure in the system. A maximum of 90 seconds may be required for gyro erection and amplifier warmup.

WARNING

Do not rely on indicator, including rate-of-turn pointer, if OFF flag is visible.

It is possible to receive erroneous indications on gyro indicator without OFF flag showing.

The turn-and-slip indicators are located below the sphere and are an integral part of the all-attitude indicator. A one-needle width deflection of the turn

TO DISENGAGE AFCS

The pilot may disengage the AFCS by one of the following actions:

1. Pressing control stick AP button.

2. Placing the standby switch in OFF position.

3. Placing both the engage and the stability augmentation switches in their OFF positions.

4. Depressing the PUSH TO SYNC button on the compass controller.

5. Moving the SET HDG switch on the compass controller.

6. Placing the aileron trim NORM/EMER switch in EMER position. In the event the switchover from automatic trim to manual trim malfunctions, or upon disengagement, the EMER position gives an additional switchover and will disengage the AFCS.

7. Moving the horizontal stabilizer manual override lever on the left console will manually overcome malfunction of the automatic pitch trimmer.

NOTE

Up to 4 seconds of override lever actuation may be required before disengagement occurs.

8. Pulling the emergency generator release handle.

LIGHTING EQUIPMENT

Interior Lights

The interior lighting system includes all instrument lights, console lights, and cockpit floodlights. A light is mounted in each instrument lens (except the oil pressure gage) to provide equal illumination over the entire face of the instrument. Two floodlights are mounted on each side of the gunsight beneath the glareshield to provide auxiliary or emergency lighting of the instrument panel. A white kneeboard floodlight incorporating a red filter is mounted on the gunsight support on the right-hand side to provide lighting for the pilot's kneeboard. Six red floodlights are installed to provide auxiliary or emergency console lighting. Four white floodlights are provided for auxiliary cockpit lighting for use with the thermal radiation closure. Instrument and console lights and the red floodlights are operative on emergency generator.

Interior Lights Control Panel

An interior lights (INT LTS) control panel (figure 1-23) mounted on the right console, contains switches for the operation of all interior lights except the four high-intensity white floodlights. Two rotary switches, marked INST and CONSOLES are turned clockwise from OFF to turn on the instrument lights and console lights, respectively. Additional turning in a clockwise direction toward the BRIGHT position increases the intensity of the light.

Aircraft reworked per A-4 Interim AFC 428 have a two-position interior lighting interrupter switch installed. The switch (labeled NORMAL and COMBAT) is located on the right-hand gunsight support adjacent to the pilot's kneeboard light (figure 1-23).

When the NORMAL, COMBAT switch is in NORMAL position, instrument panel and console lights are controlled normally by the lights control switches on the interior lights control panel. When the instrument panel and console lights are on normally, placing the switch in COMBAT position will cut off all console and instrument panel lights except those for the all-attitude indicator, accelerometer, airspeed indicator, vertical velocity indicator, altimeter, BDHI, and eight-day clock.

NOTE

When the INST lights switch is in any position other than OFF, the ladder lights are dimmed for night operations and may not be visible in daylight.

A toggle switch labeled FLOOD, with three positions, BRIGHT, DIM, and MEDIUM, controls the intensity of the red floodlights after the CONSOLES switch is turned from the OFF position. The pilot's kneeboard floodlight has a separate intensity control on the case.

The four high-intensity white floodlights, two for the instrument panel and one for each console, have a common control installed above the right-hand console on the fuselage skin. Clockwise rotation from the OFF position turns the floodlights on dimly and further clockwise rotation increases the intensity.

Exterior Lights

The exterior lights system includes position lights, fuselage wing lights, air refueling probe light, an approach light, and a taxilight. A semiflush, white, high-intensity gas discharge and low-intensity filament fuselage wing light is located under the leading edge of each wing. The aircraft has two flashing red anticollision beacons, one mounted on the top of the fuselage and the other mounted on the left main landing gear strut fairing. The angle-of-attack approach lights are mounted in the leading edge of the left wing (figure 1-24). The taxilight is installed on the right-hand main landing gear door.

The air refueling probe light is located on the right-hand intake duct forward outboard lip (figure 1-24).

Wingtip, tail, and fuselage lights are actually double lights, as both filament and gas discharge types are

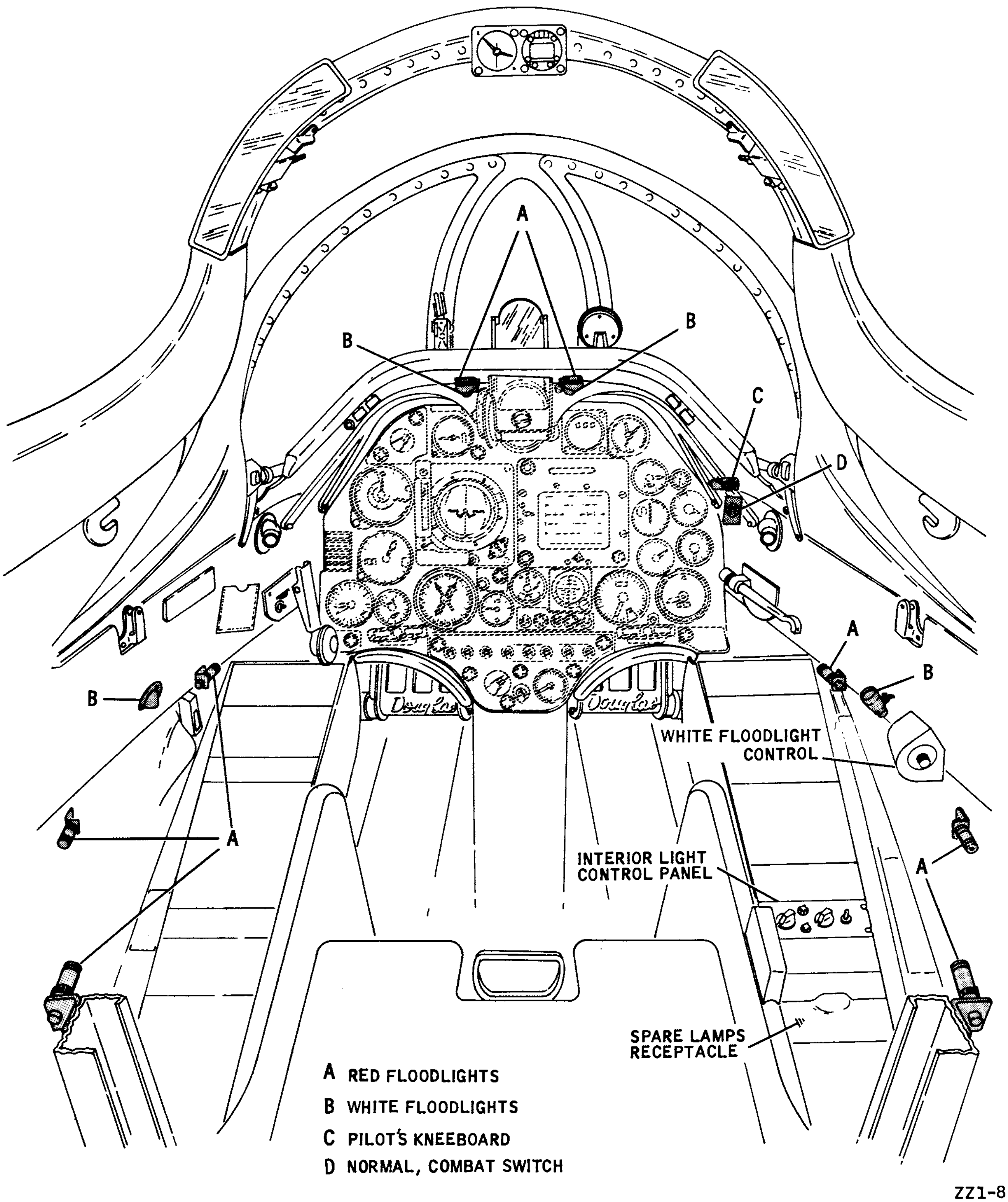


Figure 1-23. Interior Lights

JATO ARMING SWITCH

The JATO arming switch is a two-position lever-lock toggle switch labeled ARMED and OFF. To place the switch in the ARMED position, the spring-loaded toggle lever must be lifted. This arms the JATO firing circuit by energizing the JATO firing button on the catapult handgrip and the jettison circuit to the jettison switch.

JATO ARMED INDICATOR LIGHT

A JATO armed indicator light on the control panel comes on when the arming switch is energized. The press-to-test feature of this light tests the bulb.

JATO JETTISON SWITCH

The JATO jettison switch on the control panel is a guarded, momentary-control toggle switch, spring-loaded to the SAFE position. In the JATO JETT position the switch energizes a solenoid-controlled hydraulic selector valve which directs hydraulic pressure to the JATO mounting hook actuating cylinders. The mounting hooks are actuated to release both JATO bottles simultaneously.

CAUTION

When JATO bottles are installed, operation of the emergency speedbrake control will force the JATO bottles off the aircraft resulting in airframe damage.

NOTE

An interlock in the speedbrake electrical circuit prevents normal operation of speedbrakes with JATO bottles attached. Be sure the speedbrake switch on the throttle is in the CLOSED position prior to jettisioning the JATO bottles; otherwise, upon release of the JATO bottles the speedbrakes will open.

JATO FIRING BUTTON

The JATO firing button (figures 1-5 and 1-6), located at the end of the catapult handgrip energizes a relay which completes the circuit to the firing mechanism. Refer to section XI, Performance Data, for additional information on takeoff airspeeds with JATO and distances at which the JATO bottles are fired.

WARNING

To prevent possible JATO system accidents, the JATO arming switch in the cockpit shall be at OFF and a no-voltage test shall be made at the aircraft igniter terminals prior to attaching the JATO igniter leads to the bottles.

BANNER TOWING SYSTEM EQUIPMENT

Banner towing system equipment consists of a banner target, towline, banner towing platform assembly, and release unit assembly. The banner towing platform assembly suspends from the Aero 7A-1 ejector rack on the aircraft centerline station (figure 8-2).

Targets

Standard Navy or Air Force 7 1/2 x 40 feet or 6 x 30 feet banner targets may be utilized.

Towline

Recommended towline configuration is 1950 feet of 7/16-inch nylon towline attached to 50 feet of 7/32-inch armored cable leader. The armored cable leader is required at the tow plane end of the towline to prevent burn through which will occur if an all nylon towline is used.

Aircraft Towline Attachment

For detail on the banner towing system installation on the Aero 7A-1 centerline ejector rack refer to NAVAIR 01-40AVF-2.

Refer to section VIII of this supplement for towline/target release and banner towing platform assembly jettison procedures.

MISCELLANEOUS EQUIPMENT

Thermal Radiation Closure

A thermal radiation closure may be installed on the canopy structure for use on missions requiring pilot protection from the heat and light produced by nuclear explosions.

The closure consists of fixed fiberglass panels and a manually actuated segmented telescoping hood (buggy top) attached to the canopy. The glareshield installation includes light seals and an extension on the aft end. When the canopy is closed, the fixed panel on the canopy matches the glareshield in contour and

forms a glareshield extension. The buggy top pivots down and forms a light seal with the fixed panel completely sealing the pilot within a thermal protective covering. Attached to the forward segment of the buggy top are right and left handholds for opening and closing as required. The right handhold contains a latching mechanism for locking the buggy top in the open (stowed) position. Two detent ready positions hold the buggy top partially open for forward visibility. This affords the pilot partial protection in the event of a surprise burst and shortens the time required to go from the ready position to fully closed. Buggy top should stay in detented positions if subjected to turbulence or acceleration forces of 5 g or less.

OPERATION

To close the buggy top, reach back with either hand and pull forward on the right handhold to release the locking mechanism.

In cases when "hands on stick" flight is required the recommended procedure for unlatching the buggy top is to reach across the chest with the left arm while holding the stick with the right hand. Pull it forward to the ready position checking by feel to assure it centers in both detents simultaneously. To fully close the buggy top, firmly grasp the handholds with both hands and slam it shut to preclude the possibility of light leaks by seating the detents firmly on both sides. Pilots should gain proficiency in operation of the thermal radiation closure on short practice missions at safe altitudes. The closure may also be used as an instrument training hood.

To open, pull back on the handholds to override the detent pressure and telescope the closure back into its stowed and locked position.

WARNING

Ascertain that the closure locks in the stowed position to prevent its slamming shut inadvertently. This may be checked by pulling forward on the hood.

The pilot should familiarize himself with the operation of the thermal radiation closure prior to flight.

The following method is suggested:

1. Adjust seat to its lowest position.

2. Close and latch the canopy.

3. Check the accessibility of the face curtain handle.

4. Adjust seat upward exercising care not to strike enclosure.

NOTE

When the thermal radiation closure is installed, the alternate ejection handle is recommended for ejection.

5. Unlock buggy top and pull it forward to its detent ready position. Operation should be smooth and without binding. Even fingertip pressure on each handhold should assure buggy top is firmly held in both right- and left-detent positions. A pull of approximately 10 pounds is required to override the detent pressure.

6. Close buggy top by slamming firmly down using both handholds. Check for light leaks.

NOTE

In direct sunlight or equivalent there shall be no outside light directly visible to the pilot.

7. Check the accessibility of the face curtain handle.

8. Return buggy top to the open (stowed) position and check for positive latch.

9. Inspect all exposed surfaces of the thermal radiation closure for cleanliness.

EMERGENCY OPERATION

The thermal radiation closure will be jettisoned along with the canopy in emergencies. The extended aft portion of the glareshield is flexible and will deflect if contacted during ejection.

Antiexposure Suit Ventilation

An antiexposure suit ventilation control panel is installed on the left-hand console (figures FO-1 and FO-2) for use with the Mark 5 antiexposure suit.

6. Ejection seat catapult safety pin and two canopy jettison pins . . . . REMOVED

7. Emergency oxygen lanyand . . . . CONNECTED

8. DART system lanyard. . . . CONNECTED

9. Emergency oxygen bottle . . 1800 PSI

10. Harness release actuator pin. . . . . NOT VISIBLE

11. Face curtain and alternate handles . . . . STOWED

12. Emergency harness release handle stowed and parachute arming cable secured . . . . CHECK

13. Shoulder harness secured . . . . LOCKING PIN VISIBLE

14. Lap belt secure . . . . LOCKING PINS VISIBLE

15. NB-11 parachute . . . . INSTALLED

ESCAPAC IC-3 EJECTION SEAT PREFLIGHT

1. Ejection seat control safety handle (headknocker) . . . . DOWN

2. Canopy air bungee cylinder pressure gage . . . . PER INSTRUCTION ON BUNGEE

3. External canopy jettison system initiator . . . . SAFETY PIN REMOVED

4. Ejection seat catapult pin block assembly and one canopy jettison initiator pin . . . . REMOVED

5. Emergency oxygen lanyard. . . . . CONNECTED

6. DART system lanyard. . . . CONNECTED

7. Emergency oxygen bottle . . 1800 PSI

8. Canopy seat interlock cable . . . . CONNECTED

9. Face curtain and alternate handles . . . . STOWED

10. Emergency harness release handle stowed and parachute arming cable secured . . . . CHECK

11. Shoulder harness secure . . LOCKING PIN VISIBLE

12. Lap belt secure . . . . LOCKING PINS VISIBLE

13. Zero-delay lanyard . . . . . CONNECTED

INTERIOR INSPECTION

Check the general appearance of the cockpit, and make sure that all gear is properly stowed and secure. Make proper harness, oxygen, radio, and antiblackout connections, and perform the following checks before starting the engine:

CAUTION

Upon entering the cockpit, make certain that the landing gear handle is DOWN and that the hose jettison switch (tanker only) is OFF (forward).

1. Expose suit blower . . . . . . OFF

2. Emergency speedbrake knob . . . . NORMAL

3. Antiblackout suit blower, and oxygen-radio hoses . . . . CONNECT TO CONSOLE

4. Oxygen switch . . . . ON, CHECK FLOW, THEN OFF

4a. Radar Beacon . . . . OFF

5. AFCS standby switch. . . . . OFF

6. AFCS aileron trim switch . . . . NORM

7. Emergency fuel transfer switch . . . . OFF

8. Air refueling fuselage only switch (A-4F) . . . . NORM

9. Drop tanks switch. . . . . . . OFF

10. Radar selector switch (Reworked per A-4 AFC 387) . . . OFF

11. Engine starter switch . . . . PULLED UP

12. Fuel control switch. . . . . . PRIMARY

13. Manual fuel shutoff control lever . . . . NORMAL (GUARD DOWN)

14. Smoke abatement switch . . OFF

15. JATO arming-switch . . . . SAFE

16. Throttle . . . . OFF

17. Speedbrake switch . . . . CLOSE

18. Master exterior lights switch . . . . OFF

19. Flap handle . . . . UP

20. Spoiler switch . . . . OFF

21. Nosewheel steering switch . . . . NORM

22. Throttle friction wheel . . . . AS DESIRED

23. Horizontal trim disconnect switch . . . . ON

24. Accelerometer . . . . PUSH TO RESET

25. Airspeed indicator . . . . . . 0, SET

26. Vertical velocity indicator 0

27. Gunsight. . . . . SET, LOCK

28. Radar altimeter . . . . OFF

29. Emergency stores jettison select switch . . . . AS DESIRED

30. All armament switches . . . . OFF

31. Audio bypass switch . . . . . . NORM

32. Emergency handles . . . . . . STOWED

33. Arresting hook handle . . . . UP

34. Navigation computer . . . . . . SET

35. UHF function switch . . . . . . OFF

36. TACAN . . . . OFF

37. IFF master switch . . . . OFF

38. IFF controls . . . . SELECT CODE

39. Compass controller . . . . . . SLAVED, LATITUDE SET

40. Interior lights control panel . . . . ALL SWITCHES OFF

41. Emergency generator bypass switch . . . . NORMAL

42. TACAN antenna switch . . . . AS DESIRED

43. Spare lamps container . . . . ADEQUATE SUPPLY

44. Rain removal switch. . . . . . OFF

45. Engine anti-icing switch . . . OFF

46. Temperature knob . . . . AS DESIRED

47. Cabin pressurization switch . . . . NORMAL

48. Windshield defrost switch . . . . HOLD

49. Exterior lights control panel . . . . ALL SWITCHES OFF

WARNING

Make certain the ejection seat safety handle is stowed and locked in the full UP position before flight.

Before Starting the Engine

Ascertain that the areas forward and aft of the aircraft are clear of personnel and loose objects. See figure 1-54 for danger areas. Make certain that fire fighting equipment is available and manned.

Starting the Engine

An electrical power supply of 115 vac for ignition and a source of starter air is required for ground starting the engine. The two methods of starting the engine are pilot-controlled and ground-controlled starts.

PILOT-CONTROLLED STARTS

Pilot-controlled starts should be made whenever possible, to avoid starter motor overspeed. The time delay inherent in initiating or shutting off the starter air, when using hand signals, makes the ground-controlled start less desirable.

SECTION VIII
ARMAMENT SYSTEMS

TABLE OF CONTENTS

ARMAMENT EQUIPMENT

General

This section describes the minimum armament equipment required to release external stores carried in a tactical environment and a basic description of the gunsight.

Weapon systems incorporated in the aircraft include the SIDEWINDER missile system, AWW-1 fuze function control system, CP-741/A weapon release system, and the AWE-1 weapon release system in addition to the normal ordnance delivery system.

A complete description of the aircraft weapon systems, check procedures, flight procedures, and stations loadings are contained in Confidential Supplement, NAVAIR 01-40AVF-1A or A-4/TA-4 Tactical Manual, NAVAIR 01-40AV-1T. This flight manual is incomplete without the confidential supplement and the tactical manual.

The aircraft is capable of carrying a wide variety of ordnance. All stores are carried externally on five racks. A four-hook ejector bomb rack is installed on the centerline (fuselage) station, and a two-hook bomb ejector rack is installed on each of the four wing stations. The centerline rack (AERO 7A-1) can be used to carry stores requiring either 30- or 14-inch suspension. Wing racks (AERO 20A-1) are provided with 14-inch suspension only.

Armament Controls

The cockpit includes an armament panel, control stick armament switches, emergency stores release handle, gunsight, and a gunsight reticle light control panel. Controls used with specific weapon systems are covered in A-4/TA-4 Tactical Manual (NAVAIR 01-40AV-1T).

ARMAMENT PANEL

The armament panel (figure 8-1) is located below the instrument panel. Armament panel controls consist of the MASTER armament switch, STATIONS select switches, function selector switch, bomb ARM switch, GUNS switch, and EMER SEL switch.

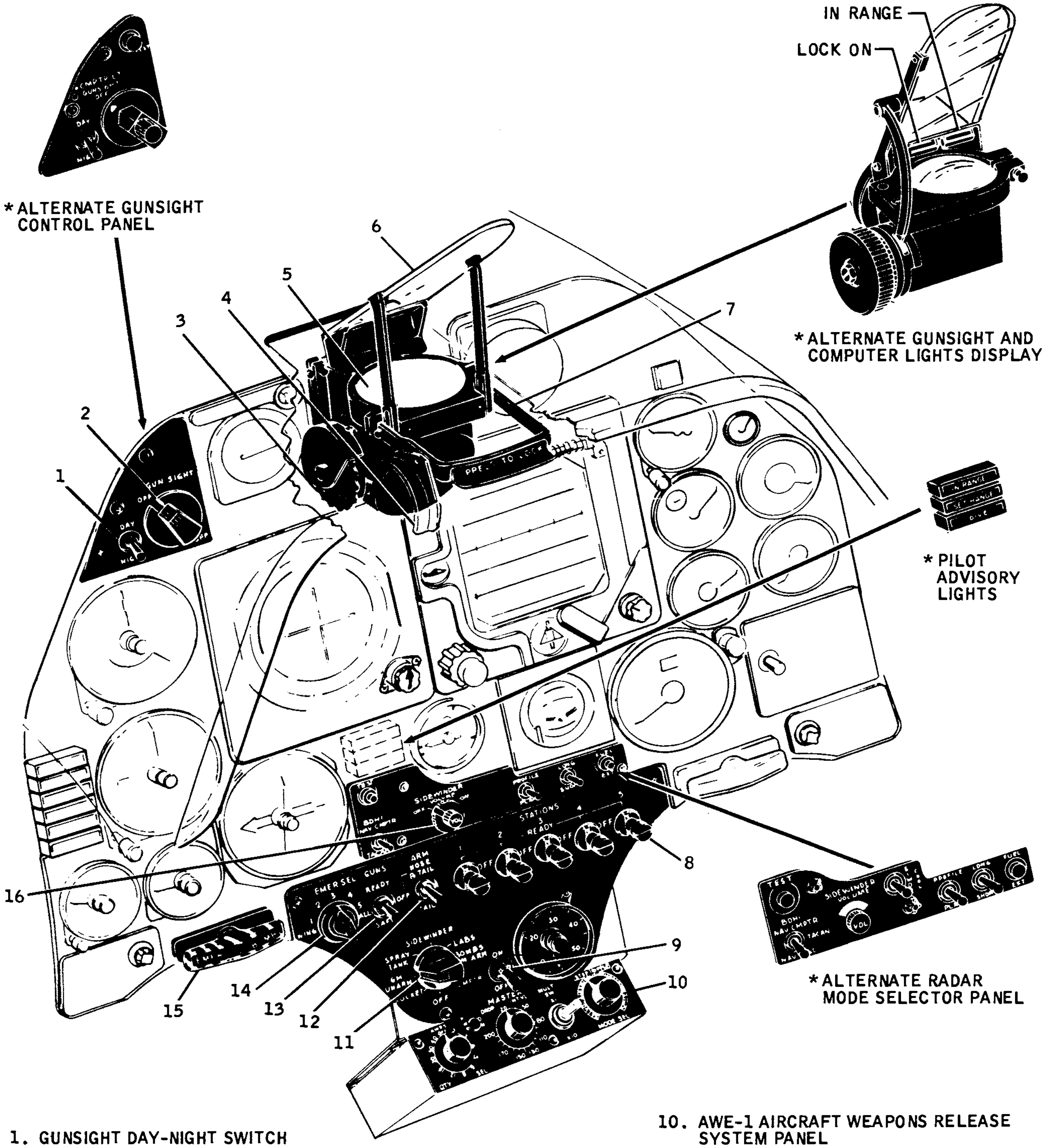
MASTER ARMAMENT SWITCH. All armament circuits are controlled by the MASTER armament switch (figure 8-1) with the exception of gun charging and emergency jettisoning of external stores. The MASTER armament switch must be in the ON position to energize armament circuits.

NOTE

- When the landing gear handle is in the DOWN position, an armament safety switch interrupts the power supply circuit to the MASTER armament switch and the gun charging circuit.

- When the aircraft is on the ground, an armament safety circuit disabling switch may be used to energize an alternate circuit for checking the armament system. This circuit is energized by momentarily closing the disabling switch located in the right-hand wheel well. Raising the landing gear or moving the MASTER armament switch to OFF will restore the armament safety circuit to normal operation.

STATIONS SELECT SWITCHES. Five STATIONS select switches (figure 8-1) are provided for armament release. Each switch has READY and OFF positions. The switches provide selection of any station or combination of stations for firing or release of external stores (except for emergency release). A number above each switch identifies the switch with the external stores station it controls.



1. GUNSIGHT DAY-NIGHT SWITCH
2. GUNSIGHT LIGHT CONTROL
3. GUNSIGHT ELEVATION CONTROL
4. ELEVATION CONTROL GUARD
5. GUNSIGHT
6. GUNSIGHT REFLECTION PLATE
7. ELEVATION CONTROL LOCKING YOKE
8. STATIONS SELECT SWITCHES
9. MASTER ARMAMENT SWITCH
10. AWE-1 AIRCRAFT WEAPONS RELEASE SYSTEM PANEL
11. FUNCTION SELECTOR SWITCH (*CMPTR POSITION)
12. BOMB ARMING SWITCH
13. GUNS SWITCH
14. EMERGENCY SELECTOR SWITCH
15. EMERGENCY STORES RELEASE HANDLE
16. SIDEWINDER COOLANT OFF-ON AND VOLUME CONTROL SWITCH

ZZ1-5-A

*BuNo. 155051, 155052, 155055, 155060-155063, and 155069.

Figure 8-1. Armament Controls

FUNCTION SELECTOR SWITCH. A rotary function selector switch (figure 8-1) selects the type of armament to be released. On A-4G aircraft BuNo. 154903 - 154910, the switch may be set in any of eight separate detent positions. Seven of the positions (labeled OFF, ROCKETS, GM UNARM, SPRAY TANK, SIDEWINDER, LABS, and BOMBS & GM ARM) are operational. The eighth detent position is not used or identified. The switch must be rotated counterclockwise to be returned to the OFF position, since a stop prevents clockwise rotation beyond the eighth detent.

A-4G aircraft BuNo. 155051, 155052, 155055, 155060 - 155063, and 155069 are equipped with the CP-741/A weapon release computer system. In these aircraft, the eighth detent position of the function selector switch (labeled CMPTR) is used for weapon computer releases.

BOMB ARM SWITCH. The bomb ARM switch (figure 8-1) is a three-position toggle switch with positions labeled NOSE & TAIL, OFF, and TAIL. Placing the switch in the NOSE & TAIL position energizes the nose and tail mechanical bomb arming units on each ejector rack. When in the TAIL position, only the tail arming unit on the ejector rack is energized. A mechanical bomb arming unit, when energized, locks onto the upper end of the arming wire, causing the arming pin to be withdrawn as the bomb falls from the aircraft. When the arming switch is in the OFF position, the mechanical arming units are not energized permitting the arming wires to fall with the bomb, and the bomb falls unarmed.

GUNS SWITCH. The GUNS switch (figure 8-1) is a two-position toggle switch with positions identified SAFE and READY. When the switch is in the SAFE position, the breechblock of each gun is in an out-of-battery position and the guns are inoperative. When in the READY position, the gun charging and firing circuits are completed, making the guns ready for firing.

EMERGENCY SELECTOR SWITCH. The rotary emergency selector switch, identified EMER SEL (figure 8-1), selects the external stores to be jettisoned when the emergency stores (EMER BOMB) release handle is pulled. The switch may be set in any of seven separate detent positions (labeled WING, 1, 2, 3, 4, 5, and ALL). With the switch placed in WING position, external stores on wing stations 1, 2, 4, and 5 will jettison when the emergency stores release handle is pulled. With the switch placed in ALL position, external stores on all stations (1 through 5) will jettison. Placing the switch in any of the numerical positions and pulling the emergency stores release handle, will jettison only the external stores on the corresponding station.
The emergency selector switch and emergency stores release will function on either the main or emergency generator.

CONTROL STICK ARMAMENT SWITCHES

BOMB RELEASE BUTTON. The bomb release button, often referred to as the "pickle" switch, is located on the left side of the control stick grip and is identified with the letter "B." The bomb release button functions only when operating on the main generator.

GUN-ROCKET TRIGGER. The gun-rocket trigger is located on the front of the control stick grip and is the initiator of gun and/or rocket firing when the proper conditions are established. When depressed, the gun-rocket trigger fires guns and/or rockets in any one of three arrangements: (1) With the function select switch set in OFF and the GUNS switch in READY, the guns are fired. (2) With the function select switch set in ROCKETS and the GUNS switch in SAFE, the rockets will be fired from all stations that have the STATIONS select switches set in READY. (3) With the function select switch set in ROCKETS and the GUNS switch in READY, the guns will fire and all rockets will fire from stations that have the STATIONS select switches set in READY. The gun-rocket trigger functions only when operating on the main generator.

EMERGENCY STORES RELEASE HANDLE. An emergency stores release handle, identified EMER BOMB (figure 8-1), is located on the lower left side of the instrument panel. Pulling the handle closes a switch in the emergency release circuit, bypassing the normal release controls. Power to the emergency circuit is supplied by the primary bus which is energized by either the main or emergency generator. Stores selected by the EMER SEL switch may be released regardless of the position of the landing gear control or MASTER armament switch.

EXTERNAL STORES RELEASE. Release of external stores from the ejector-type racks is accomplished by electrical detonation of cartridges. When cartridges are fired by pressing the bomb release button, the initial force is an upward thrust which opens the hooks, followed by a downward ejector thrust of several inches which forces the store clear of the aircraft. An ejector foot is located aft of center on the bomb rack to counteract the twisting moment of the bomb caused by

drag forces in high-speed flight. Each ejector rack contains two cartridges; both are fired by either the normal or emergency release circuit.

NOTE

Normal release of external stores is possible only while operating on main generator. Emergency release may be accomplished while operating on the main or emergency generator.

Normal Dive Bomb Release

1. ARM switch . . . . TAIL OR NOSE & TAIL
2. Function selector switch . . . . . BOMBS & GM ARM
3. STATIONS select switches (as desired) . . . . READY
4. MASTER armament switch . . . ON
5. Bomb release button . . . . DEPRESS

NOTE

For releasing stores in an inert condition, the bomb ARM switch (controlling mechanical arming circuits) may be in the OFF position and/or the function selector switch on the AN/AWW-1 fuze function control panel (controlling electrical arming circuits) must be in the SAFE position.

Emergency Release

1. Emergency select (EMER SEL) switch . . . . AS REQUIRED
2. Emergency stores (EMER BOMB) release handle . . . . PULL

WARNING

Do not jettison bombs below maximum fragmentation envelope whether in an armed or safe condition.

CAUTION

When the emergency stores release handle is used to jettison wing stores only (EMER SEL switch set in WING) ensure that the STATIONS select switch for the centerline station is in the OFF position to prevent electrical feedback through the normal bomb release circuit and inadvertent release of the center store.

Gunsight

A lighted gunsight (figure 8-1) is located directly above the instrument panel. Gunsight controls include an elevation control knob, an elevation control locking yoke, and a gunsight reticle light control.

Light is beamed through a condenser lens and a ladder-type (fixed) reticle upward through a collimating lens to a reflector plate where it is superimposed upon the target. When using the gunsight with guns or rockets, the proper ballistic drop of the projectile is set into the gunsight as down lead. The center of the reticle image is kept on the center of the target, provided it is a fixed target. If the target is moving, the required lead angle must be established by using the graduations on the reticle.

The gunsight elevation control knob is located on the left side of the gunsight and is used to adjust the angle of the glass reflector for increasing or decreasing lead angle. Prior to changing lead angle with the elevation control, the locking yoke must be lifted to an unlocked position. The gunsight elevation control knob on aircraft reworked per A-4 AFC 451 has improved braking action on sight elevation adjustment mechanism to prevent loss of boresight through flight vibration or landing shock.

CAUTION

Failure to completely unlock the yoke prior to rotating the elevation control knob may damage the mechanism and result in sight elevation errors.

After setting the elevation control knob to the desired lead angle, the locking yoke must be pressed firmly against the sight body in the locked position.

CAUTION

When moving the yoke into the locked position, do not press on the guard attached to the locking yoke.

GUNSIGHT RETICLE LIGHT CONTROL

The gunsight reticle light control (figure 8-1) is located on the upper left corner of the instrument panel. By rotating the control knob, either of two filaments may be selected for lighting. Light intensity can be adjusted between the OFF positions for either filament.

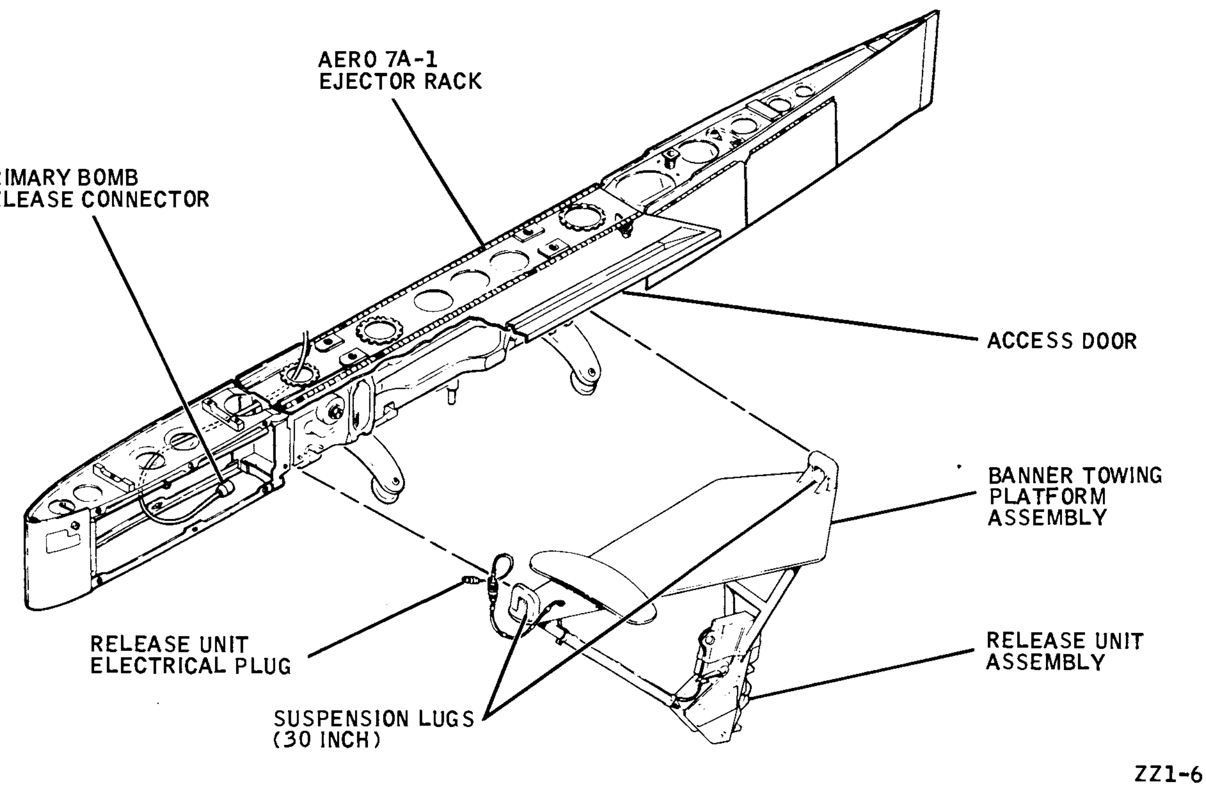


Figure 8-2. Banner Towing Platform and Release Assembly

On A-4 aircraft reworked per A-4 AFC 353-II, a two-position toggle switch labeled DAY-NIGHT is located adjacent to the gunsight reticle light control. When the switch is in the DAY position, a gunsight light resistor circuit (also added per A-4 AFC 353-II) is bypassed allowing maximum power to the gunsight reticle light control rheostat. With the switch in the NIGHT position, power is directed through the gunsight light resistor circuit, resulting in lower light intensity variance controlled by the reticle light control rheostat.

Aircraft reworked per A-4 AFC 388 have concentric light intensity control knobs on the gunsight lighting control panel. The inner knurled knob, within the gunsight light control knob, is labeled CMPTR LT and controls the intensity of the CP-741/A computer LOCK ON and IN RANGE display lights. The computer display lights are mounted on the upper gunsight assembly for pilot convenience. Although the CMPTR LT control knob does not have a direct function in gunsight light control, it enables the pilot to adjust the intensity of the display lights at the most comfortable level for gunsight vision.

Banner Towing System

The banner towing system utilizes the aircraft weapon normal release system and the Aero 7A-1 centerline ejector rack in conjunction with the banner towing platform assembly and the release unit assembly (figure 8-2).

The banner towing platform assembly is suspended from the Aero 7A-1 ejector rack. Release of the banner tow target is accomplished with the aircraft weapon normal release system as follows:

1. MASTER arm switch . . . . ON
2. STATIONS select switch . . . . . . 3 READY
3. Function selector switch . . . . . . BOMBS & GM ARM
4. Bomb release button . . . . DEPRESS

The banner towing platform assembly can be jettisoned by means of the aircraft emergency release system.

1. Emergency select (EMER SEL) switch . . . . STATION 3
2. Emergency stores (EMER BOMB) release handle . . . . PULL

TABLE 8-2. EJECTION VELOCITIES

Rack	Store Weight (lb)	Ejection Velocity (fps)	Recommended CP-741/A Eject Velocity (fps)
MER/TER-7	All	*	5
PMBR/MBR	All	0	0
Aero-7A-1	250	35	35
(1 MK 1 MOD 2 and MK 2 MOD 0 Cartridges)	500	29.5	30
	750	25.5	25
	1000	22.7	20
	2000	16.5	15
Aero-20A-1	250	24	25
	500	19.5	20
	750	15.4	15
	1000	12.5	10

*The MER/TER-7 ejection velocity normal to fuselage reference plane varies with rack station and store weight. This variance is from 4.3 fps to 9.3 fps. By using an average 5 fps (switch module ejection velocities are set in 5-fps increments from 0 to 45 fps), setting the maximum system error due to the ejection velocity will be less than 5 mils.

be reset in flight. Parameters which are set into the weapon control panel for dive-toss bombing are:

1. ATTACK MODE switch to TOSS or STIK.

2. Ballistic selector switch to the module corresponding to the ordnance to be released.

3. BURST height appropriate to the ordnance/fuzing/target combination.

4. TARGET height above mean sea level.

5. D-VALUE as determined from worksheet.

Settings in steps 4 and 5 are used only in BARO mode toss bombing and perform no function during RADAR mode attacks. However, radar malfunction or failure to achieve lock-on is an ever-present possibility. If no radar ranging information is provided to the CP-741/A computer, the CP-741/A computer will automatically use the values set into the weapon control panel to compute a BARO solution. Therefore, pilots should set into these controls the best available information for an alternative BARO mode attack in case the radar does not function as planned.

The preflight procedure for preparing the AN/APG-53B radar to function in its air-to-ground mode is described in Section I.

Turn on the gunsight, set it at the desired brilliance, conduct optical boresight, check and ensure that the sight drum is set at 0 mils sight depression.

If multiple releases are planned, the AWE-1 cockpit intervalometer should be set up for stick bombing. (RIPPLE mode and interval.) The CP-741/A sends out the first release signal and the intervalometer sends out all additional releases. The release signal (aural tone) from the computer continues until the last bomb is released. In STEP mode, tone ceases when bomb button is released.

AFTER ENGINE START

Turn the Radar Mode Selector Switch to STANDBY. Allow at least 3 minutes for equipment warmup prior to selecting an operating mode of the radar.

THE DELIVERY

The armament switches are set up as follows:

1. AWE-1 QUANTITY, INTERVAL AND MODE. . SELECTED

2. NOSE/TAIL ARM or AWW-1. . . . . SELECTED

3. MIL Setting. . . . . . ZERO

4. CP-741/A Weapon Control Panel . . . . SET

5. Radar . . . . A/G

6. Station Selector Switch . . . . DESIRED STATIONS

7. Function Selector Switch . . . . BOMBS & GM ARM

8. Master Armament Switch . . . . ON

NOTE

If (INT) AAC 444 is not incorporated in AWE-1, position master arm switch to ON before turning AWE-1 on.

Maneuver the aircraft to be within the capability envelope of the computer bombing system at time of pullup (figures 8-11 and 8-12). Maximum slant range is 22,500 feet, or a maximum altitude of 15,000 feet in the BARO mode.

After ensuring that the IN RANGE light is illuminated, the pilot may initiate his release at any time he desires. To release the bombs, put the pipper on the target, depress the bomb release button, and establish a 2- to 6-g pullup. It is not necessary to fly a g schedule during the pullup. However, a higher g during pullup will provide a more rapid release and reduce the down range travel of the aircraft. These factors will tend to improve the accuracy of delivery. Therefore, fly the maneuver at the highest g load that is comfortable. The bomb release tone will come on when the bomb release button is depressed and go off when the last bomb selected is automatically released. If a step mode of the AWE-1 is used, the tone will go off at bomb button release.

When repeated passes are planned, a straight and level leg of at least 1 minute will permit precession of the AJB-3A Gyro to be corrected.

The CP-741/A bombing system does not provide corrections for the effects of the existing wind. Either of two approaches can be used to correct for these effects:

1. Offset the aim point into the wind a distance that will compensate for the effects of the wind at release altitude.

2. Track the target with the pipper. Crosswind effects will require the upwind wing low to keep the pipper on target in coordinated flight. Depress the bomb button while maintaining the pipper on target and pull up in the plane perpendicular to the plane of the wings at the time of pickle. This maneuver corrects for one-half of the effects of crosswind. To correct also for the effects of range wind, keep the pipper vertically aligned with the target but offset the aim point along the run-in track into the range wind component.

Large impact errors can be expected when making repeated runs in the BARO mode at low dive angles. Vertical gyro precession will result in slant range error input to the computer.

For best accuracy, a 2- to 4-second tracking time is recommended. The recommended tracking time is not mandatory but will improve accuracy. The two most important items are (1) "In-Range" light illumination and (2) steady pipper tracking.

Accuracy is seriously degraded if bomb release button is depressed while pipper is sweeping through the target.

CAUTION

Do not release bombs if the "In-Range" light is not illuminated. This light indicates the computer has a bombing solution. Release at slant ranges near 10,000 feet without an "In-Range" light can result in impact errors up to 3000 feet.

NOTE

The information in table 8-3 will allow additional use of the MK 76 series and the MK 76 weapon adapter modules until specific modules are available.

STATION LOADING

Refer to Confidential Supplement NAVAIR 01-40AVC-1A or A-4/TA-4 Tactical Manual, NAVAIR 01-40AV-1T.

MISSILE, AIR-TO-GROUND

Refer to Confidential Supplement NAVAIR 01-40AVC-1A, Confidential Supplement NAVAIR 01-40AVF-1A, or A-4/TA-4 Tactical Manual, NAVAIR 01-40AV-1T.

ALPHABETICAL INDEX

FOLDOUT ILLUSTRATIONS

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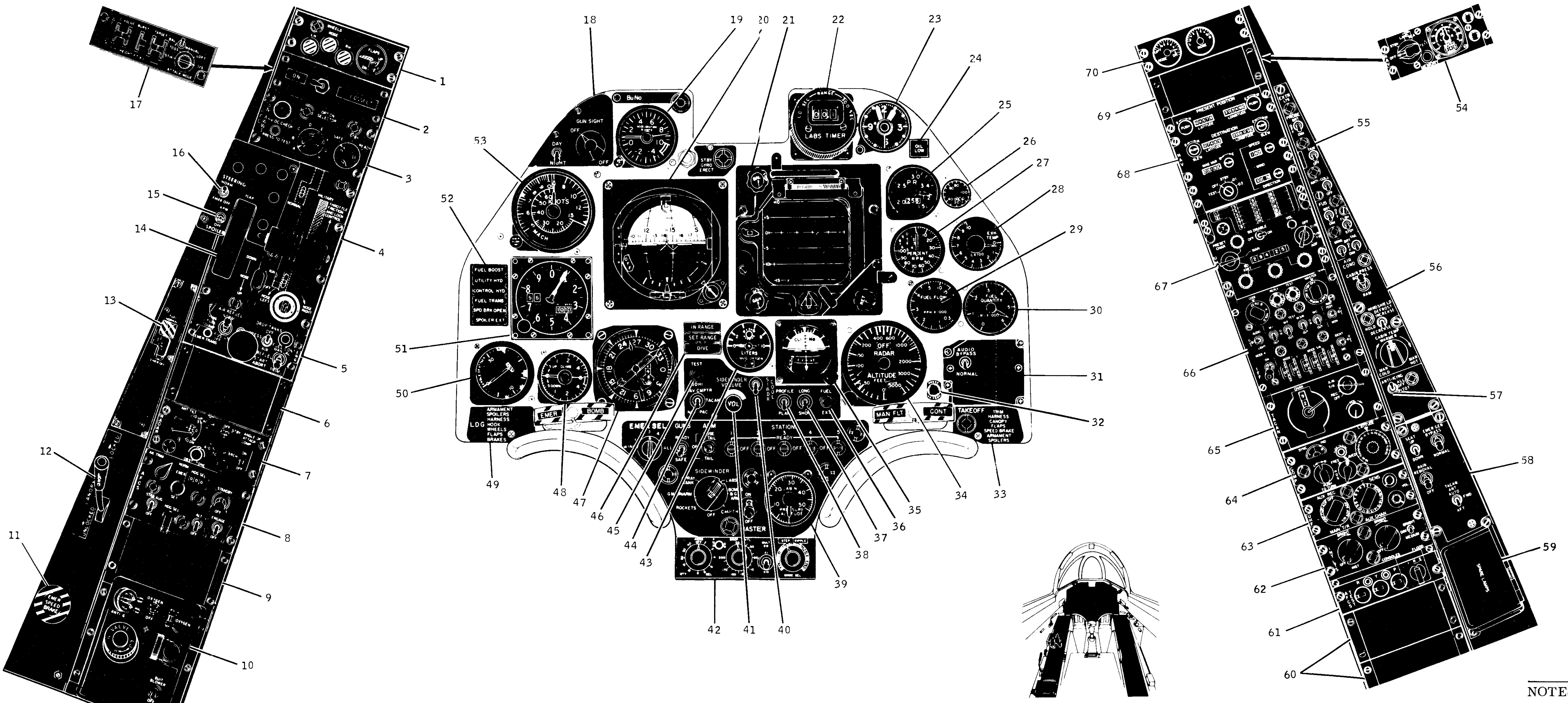

1. WHEELS AND FLAPS POSITION INDICATOR PANEL
2. HORIZONTAL TRIM DISCONNECT SWITCH
3. AWW-1 FUZE FUNCTION CONTROL PANEL
4. THROTTLE PANEL
5. ENGINE CONTROL PANEL
6. BLANK PANEL
7. RADAR CONTROL PANEL
8. AUTOPILOT CONTROL PANEL
9. BLANK PANEL
10. AIRCREW SERVICES PANEL
11. EMERGENCY SPEEDBRAKE CONTROL
12. CANOPY CONTROL HANDLE
13. MANUAL FUEL SHUTOFF CONTROL LEVER
14. FLAP HANDLE
15. SPOILER ARM SWITCH
16. NOSEWHEEL STEERING SWITCH
17. CP-741/A WEAPON CONTROL PANEL (ALTERNATE PANEL)
18. GUNSIGHT PANEL
19. ACCELEROMETER
20. ALL-ATTITUDE INDICATOR
21. RADAR SCOPE
22. LABS TIMER (INOPERATIVE)
23. 8-DAY CLOCK
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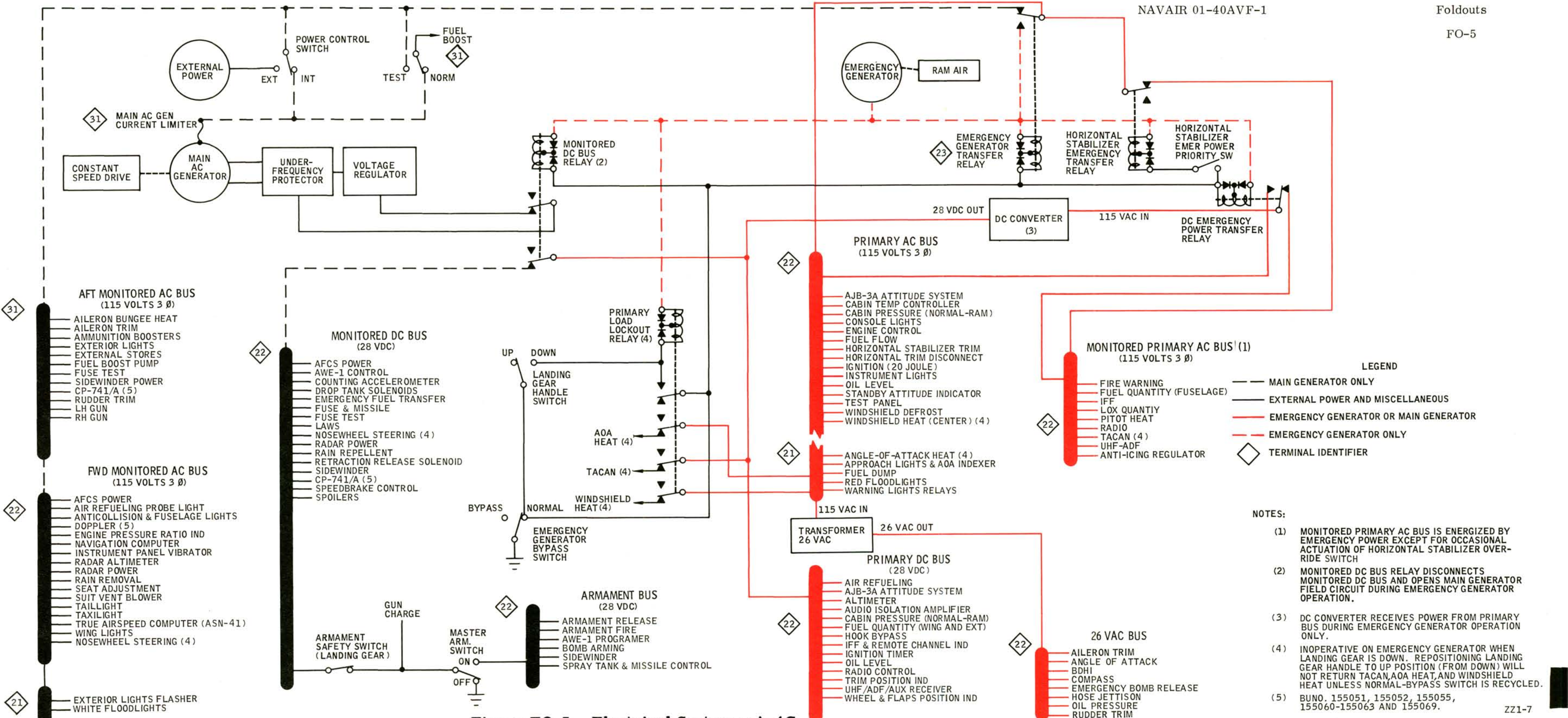
26. OIL PRESSURE INDICATOR
27. TACHOMETER
28. EXHAUST GAS TEMPERATURE INDICATOR
29. FUEL FLOW INDICATOR
30. FUEL QUANTITY INDICATOR
31. AUDIO BYPASS SWITCH PANEL (1)
32. RADAR ALTIMETER LOW LIMIT WARNING LIGHT
33. TAKEOFF CHECKLIST
34. RADAR ALTIMETER (1)
35. STANDBY ATTITUDE INDICATOR
36. FUEL INT-EXT SWITCH
37. RADAR LONG-SHORT SWITCH
38. RADAR PROFILE-PLAN SWITCH
39. ARMAMENT CONTROL PANEL
40. SIDEWINDER COOLING SWITCH
41. SIDEWINDER VOLUME CONTROL
42. AWE-1 AIRCRAFT WEAPONS RELEASE SYSTEM PANEL
43. LIQUID OXYGEN QUANTITY INDICATOR
44. BDHI NAV COMPUTER, TACAN, NAVPAC SWITCH
45. TEST SWITCH (MASTER PRESS TO TEST)
46. PILOT ADVISORY LIGHTS (2)
47. BEARING-DISTANCE-HEADING INDICATOR (BDHI)
48. VERTICAL VELOCITY INDICATOR
49. LANDING CHECKLIST
50. ANGLE-OF-ATTACK INDICATOR
51. ALTIMETER
52. CAUTION PANEL (LADDER LIGHTS)
53. AIRSPEED INDICATOR
54. DOPPLER RADAR CONTROL PANEL (2)
55. EXTERIOR LIGHTS PANEL
56. AIR CONDITIONING PANEL
57. ANTI-ICING SWITCH
58. MISCELLANEOUS SWITCHES PANEL
59. SPARE LAMP CONTAINER
60. BLANK PANEL
61. AFCS TEST PANEL
62. INTERIOR LIGHTS PANEL
63. AUXILIARY UHF CONTROL PANEL
64. COMPASS CONTROL PANEL
65. TACAN CONTROL PANEL
66. IFF CONTROL PANEL
67. UHF CONTROL PANEL
68. NAVIGATION COMPUTER CONTROL PANEL
69. BLANK PANEL (1)
70. TRIM POSITION INDICATOR PANEL

ZZ1-4-A

Figure FO-2. A-4G Cockpit – Typical Left, Instrument, and Right Panels

NOTES: (1) BuNo. 154903-154910
(2) BuNo. 155051, 155052, 155055, 155060-155063, and 155069



NOTES:

(1) MONITORED PRIMARY AC BUS IS ENERGIZED BY EMERGENCY POWER EXCEPT FOR OCCASIONAL ACTUATION OF HORIZONTAL STABILIZER OVER-RIDE SWITCH

(2) MONITORED DC BUS RELAY DISCONNECTS MONITORED DC BUS AND OPENS MAIN GENERATOR FIELD CIRCUIT DURING EMERGENCY GENERATOR OPERATION.

(3) DC CONVERTER RECEIVES POWER FROM PRIMARY BUS DURING EMERGENCY GENERATOR OPERATION ONLY.

(4) INOPERATIVE ON EMERGENCY GENERATOR WHEN LANDING GEAR IS DOWN. REPOSITIONING LANDING GEAR HANDLE TO UP POSITION (FROM DOWN) WILL NOT RETURN TACAN,AOA HEAT,AND WINDSHIELD HEAT UNLESS NORMAL-BYPASS SWITCH IS RECYCLED.

(5) BUNO. 155051, 155052, 155055, 155060-155063 AND 155069.

Figure FO-5. Electrical System – A-4G

CHANGE NOTICE

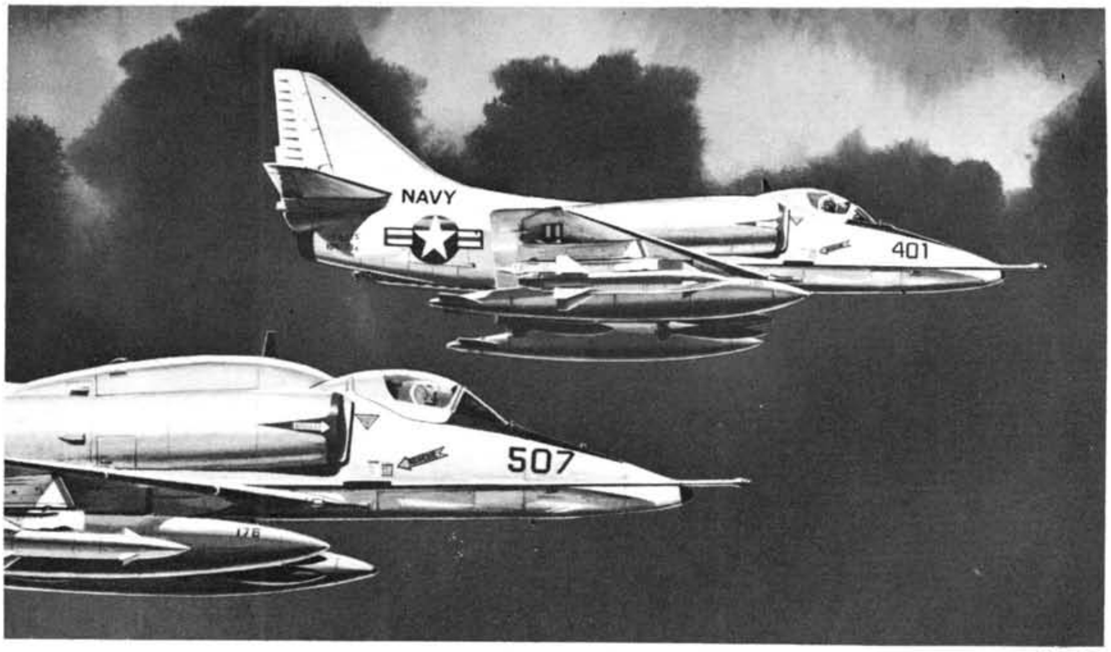
THESE ARE SUPERSEDING OR SUPPLEMENTARY PAGES TO SAME PUBLICATION OF PREVIOUS DATE

Insert these pages into basic publication
Destroy superseded pages

NAVAIR 01-40AVC-1

NATOPS
Flight Manual
NAVY MODEL
A-4E/F
AIRCRAFT

THIS PUBLICATION IS INCOMPLETE WITHOUT
A-4/TA-4 TACTICAL MANUAL (NAVAIR 01-40AV-1T)



GG1-56

ISSUED BY AUTHORITY OF THE CHIEF OF NAVAL OPERATIONS
AND UNDER DIRECTION OF THE COMMANDER,
NAVAL AIR SYSTEMS COMMAND

15 November 1968
Changed 15 November 1970

LIST OF EFFECTIVE PAGES

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INTERIM CHANGE SUMMARY

The following Interim Changes have been canceled or previously incorporated in this manual:

INTERIM CHANGE NUMBER(S)	REMARKS/PURPOSE
1 thru 42	Canceled or Previously Incorporated (A-4E/F)

The following interim Changes have been incorporated in this Change/Revision:

INTERIM CHANGE NUMBER	REMARKS/PURPOSE
43	Airstarts: Metering of Fuel
44	Canceled IC #41
45	Restricted Forward Stick Travel
46	C-11/C-11-1 Catapults: Weight Limitation
47	Revised per NAVAIRSYSCOM IC #49
48	Barricade Arrestment Weight Increase
49	J52-P-8A/B Minimum Engine Inflight RPM
50	CSD Failure

Interim Changes Outstanding – To be maintained by the custodian of this manual:

INTERIM CHANGE NUMBER	ORIGINATOR/DATE (or DATE/TIME GROUP)	PAGES AFFECTED	REMARKS/PURPOSE

DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
WASHINGTON, D.C.-20350

15 November 1968

LETTER OF PROMULGATION

1. The Naval Air Training and Operating Procedures Standardization Program (NATOPS) is a positive approach towards improving combat readiness and achieving a substantial reduction in the aircraft accident rate. Standardization, based on professional knowledge and experience, provides the basis for development of an efficient and sound operational procedure. The standardization program is not planned to stifle individual initiative but rather, to aid the Commanding Officer in increasing his unit's combat potential without reducing his command prestige or responsibility.

2. This manual standardizes ground and flight procedures but does not include tactical doctrine. Compliance with the stipulated manual procedure is mandatory except as authorized herein. In order to remain effective, NATOPS must be dynamic and stimulate rather than suppress individual thinking. Since aviation is a continuing progressive profession, it is both desirable and necessary that new ideas and new techniques be expeditiously evaluated and incorporated if proven to be sound. To this end Type/Fleet/Air Group/Air Wing/Squadron Commanders and subordinates are obligated and authorized to modify procedures contained herein, in accordance with the waiver provisions established by OPNAVINST 3510.9 series, for the purpose of assessing new ideas prior to initiating recommendations for permanent changes. This manual is prepared and kept current by the users in order to achieve maximum readiness and safety in the most efficient and economical manner. Should conflict exist between the training and operating procedures found in this manual and those found in other publications, this manual will govern.

3. Checklists and other pertinent extracts from this publication necessary to normal operations and training should be made and may be carried in Naval Aircraft for use therein. It is forbidden to make copies of this entire publication or major portions thereof without specific authority of the Chief of Naval Operations.

Thomas F. Connolly

THOMAS F. CONNOLLY
Vice Admiral, USN
Deputy Chief of Naval Operations (Air)

NATOPS Advisory Group Member in the Chain of Command by priority message.

Submit routine change recommendations to the Model Manager on OPNAV Form 3500-22.

Address routine changes to:

Commanding Officer
VA-125
NAS Lemoore, California 93245
Attn: NATOPS Evaluator

NATOPS FLIGHT MANUAL INTERIM CHANGES (FMIC'S)

FMIC'S are changes or corrections to the NATOPS Flight Manuals promulgated by CNO or NAVAIRSYSCOM. FMIC'S may be received by the individual custodian as a printed page or pages, or by the commands as a naval message. NATOPS Coordinators, Evaluators, and Instructors shall maintain a file of outstanding FMIC's.

INTERIM CHANGE SUMMARY

The interim change summary in each manual is provided for the purpose of maintaining a complete record of all interim changes issued to the manual. Each time the manual is changed or revised, the interim change summary will be updated to indicate disposition and/or incorporation of previously issued interim changes. When a regular change is received, the interim change summary should be checked to ascertain that all outstanding interim changes have been either incorporated or cancelled; those not incorporated should be re-entered and noted as applicable.

CHANGE SYMBOLS

Revised text is indicated by a black vertical line in either margin of the page, like the one printed next to this paragraph. The change symbol shows where there has been a change. The change might be material added or information restated.

WARNINGS, CAUTION, AND NOTES

The following definitions apply to WARNINGS, CAUTIONS, and NOTES found throughout the manual.

WARNING

Operating procedures, practices, conditions, etc., which may result in injury or death, if not carefully observed or followed.

CAUTION

Operating procedures, practices, conditions, etc., which, if not strictly observed, may damage equipment.

NOTE

An operating procedure, condition, etc., which is essential to emphasize.

WORDING

The concept of word usage and intended meaning which has been adhered to in preparing this Manual is as follows:

Shall has been used only when application of a procedure is mandatory.

Should has been used only when application of a procedure is recommended.

May and need not have been used only when application of a procedure is optional.

Will has been used only to indicate futurity, never to indicate any degree of requirement for application of a procedure.

NATOPS CHANGE RECOMMENDATION
OPNAV FORM 3500/22 (8-65) 0107-722-2001

TO BE FILLED IN BY ORIGINATOR

ORIGINATORS CHANGE RECOMMENDATION IDENT. NO.________	DATE	☐ NATOPS MANUAL ☐ NATOPS FLIGHT MANUAL	☐ FLIGHT MANUAL
MODEL AIRCRAFT	SECTION/CHAPTER	PAGE NUMBER	PARAGRAPH NUMBER

RECOMMENDATION (be specific)

SAMPLE

☐ CHECK IF CONTINUED ON BACK

JUSTIFICATION

NAME	UNIT

ADDRESS

TO BE FILLED IN BY MODEL MANAGER (Return to Originator)

FROM	DATE

TO

REFERENCE
(a) Your Change Recommendation Number____________

☐ Your change recommendation number__________is acknowledged. It will be held for action of the review conference planned for__________to be held at__________

☐ Your change recommendation is reclassified URGENT and forwarded for approval to__________ __________by my DTG__________

/S/__________ FOR MODEL MANAGER. | __________AIRCRAFT

A – 8345

GPO 931-057

AIRCRAFT CHANGE SUMMARY

The A-4 aircraft have been modified by many field changes which affect operation of the aircraft and equipment. Throughout this manual, field changes are referred to by Aircraft Service Change (ASC) or Airframe Change (AFC) number, one or the other of which is assigned to the required modification. Following is a list of ASC'S/AFC'S that apply to this manual. The change is briefly described and, where applicable, information is given for visual determination of incorporation. Since all ASC'S/AFC'S referred to on this page may not be incorporated into a particular aircraft, the pilot must check with the maintenance department to determine which changes have been installed in the aircraft.

AFC No.	Description	Visual Identification
200	Radar Altimeter & Bearing Distance Heading Indicator	Inst Panel
202	Air Refueling Probe Light	RH Wedge Console
204	Canopy Jettison System	RH Side Cockpit
207A	Fuel Boost Pump Circuit Wiring	Wiring Mod.
209	Wing Fuel Dump and Emergency Transfer	Fuel Sys Mod.
213	JATO Provisions	Throttle Quad.
217	Elapsed Time Clock	Windshield
219	Remote Attitude Indicating System	Inst Panel
221	Dual Purpose Red and High Intensity White Cockpit Light	Cockpit
230	Horizontal Stabilizer Nose Down Incidence	Wiring/System Mod.
241	Shrike Missile Capability	Armament Panel
256	Bullpup Adaptive Control	LH Console
258	AJB-3/A Loft Bomb ON/OFF Switch (Gyro Cutout Switch)	Wiring Mod.
268, -I, -II, -III	Approach Power Compensator	LH Glareshield
272	Armament Station Selector Switches	Armament Panel
282	Doppler Navigation System	RH Console
294	(LAWS) Warning System	LAWS Light — Glareshield
303-1	Universal Stores Release System	Cockpit
304	Windshield Rain Repellent System	LH Console
310	Canopy Emergency Jettison Handle	RH Side Cockpit
315	Two Point Oil Quantity Indicating System	Inst Panel
317	Fuel Transfer Bypass Switch	RH Wedge Console
318	Walleye Weapon System	Armament Panel
325, -III, -IX	Upper Avionics Compartment (ECM, Etc.)	LH Glareshield

NEW

AFC No.	Description	Visual Identification
327	Eight-Day Clock	Inst Panel
331	Improved Air Bleed System for Air Turbine Transfer Pump	None
333-1	LAWS, Installation	Wiring Mod.
343-I, -II	Communications Equipment	RH Console
344	Emergency Bomb Release Selector Switch	Armament Panel
345	Warning Light Press-to-Test Circuit	Inst Panel
353	Gunsight Mount Rigidity and Light Dimming Circuit	Inst Panel
356	IFF MODE 4 Failure Light	RH Glareshield
359	Escapac I Zero-Zero Escape System	Cockpit
360-1	Upper Avionics Compartment	LH Glareshield
376	Full Shrike System Early A-4E	Armament Panel
382	Exhaust Smoke Abatement	LH Wedge Console
386	Shrike Improved Display System (SIDS)	Armament Panel
387	Radar Control Console	LH Console
394, -I, -II, -III, -VI	Supplement ECM	Wiring/Control Mod.
395	Improved Walleye Display	Inst Panel
400	J52-P-8A Engine Installation	Cockpit Placard
418-II	AN/ALE Chaff Dispenser	LH Glareshield
423	Disable LAWS Unreliability Tone with APR-27 Installed	Wiring Mod.
428	Instrument Panel Lighting Control	Wiring/Control Mod.
429	Nosewheel Steering	Throttle Quad.
430	Cockpit Landing Checklist Panel	LH Inst Panel
442	Wing Lift Spoilers	Throttle Quad.
451	Gunsight, Adjustment Knob Assembly	Center Glareshield
451-I	Interchange Angle-of-Attack Indexer and Accelerometer	Instrument Panel
456	Angle-of-Attack Indexer	Above Glareshield
464	AXC-666 Air Data Computer Wiring	Wiring Mod.
473	AN/APN-154(V) Radar Beacon	LH Console

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FOREWORD

SCOPE

The NATOPS Flight Manual is issued by the authority of the Chief of Naval Operations and under the direction of Commander, Naval Air Systems Command in conjunction with the Naval Air Training and Operating Procedures Standardization (NATOPS) Program. This manual contains information on all aircraft systems, performance data, and operating procedures required for safe and effective operations. However, it is not a substitute for sound judgement. Compound emergencies, available facilities, adverse weather or terrain, or considerations affecting the lives and property of others may require modification of the procedures contained herein. Read this manual from cover to cover. It's your responsibility to have a complete knowledge of its contents.

APPLICABLE PUBLICATIONS

The following applicable publications complement this manual:

NAVAIR 01-40AV-1T(A) (supplement)

NAVAIR 01-40AV-1T (tactical manual)

NAVAIR 01-40AV-1TB (tactical pocket guide)

NAVAIR 01-40AVC-1B (checklist)

NAVAIR 01-40AVC-1-6 (functional checklist)

HOW TO GET COPIES

Automatic Distribution

To receive future changes and revisions to this manual automatically, a unit must be established on the automatic distribution list maintained by the Naval Air Technical Services Facility (NATSF). To become established on the list or to change distribution requirements, a unit must submit NAVWEPS Form 5605/2 to NATSF, 700 Robbins Ave., Philadelphia, Pa. 19111, listing this manual and all other NAVAIR publications required. For additional instructions refer to BUWEPSINST 5605.4 series and NAVSUP Publication 2002.

Additional Copies

Additional copies of this manual and changes thereto may be procured by submitting Form DD 1348 to NPFC Philadelphia in accordance with NAVSUP Publication 2002, Section VIII, Part C.

UPDATING THE MANUAL

To ensure that the manual contains the latest procedures and information, NATOPS review conferences are held in accordance with OPNAVINST 3510.11 series.

CHANGE RECOMMENDATIONS

Recommended changes to this manual or other NATOPS publications may be submitted by anyone in accordance with OPNAVINST 3510.9 series.

Routine change recommendations are submitted directly to the Model Manager on OPNAV Form 3500-22 shown on the next page. The address of the Model Manager of this aircraft is:

Commanding Officer
VA-127
NAS Lemoore, California 93245
Attn: NATOPS Evaluator

Change recommendations of an URGENT nature (safety of flight, etc.), should be submitted directly to the NATOPS Advisory Group Member in the chain of command by priority message.

YOUR RESPONSIBILITY

NATOPS Flight Manuals are kept current through an active manual change program. Any corrections, additions, or constructive suggestions for improvement of its content should be submitted by routine or urgent change recommendation, as appropriate, at once.

NATOPS FLIGHT MANUAL INTERIM CHANGES

Flight Manual Interim Changes are changes or corrections to the NATOPS Flight Manuals promulgated by CNO or NAVAIRSYSCOM. Interim Changes are issued either as printed pages, or as a naval message. The Interim Change Summary page is provided as a record of all interim changes. Upon receipt of a change or revision, the custodian of the manual should check the updated Interim Change Summary to ascertain that all outstanding interim changes have been either incorporated or canceled; those not incorporated shall be recorded as outstanding in the section provided.

CHANGE SYMBOLS

Revised text is indicated by a black vertical line in either margin of the page, adjacent to the affected text, like the one printed next to this paragraph. The change symbol identifies the addition of either new information, a changed procedure, the correction of an error, or a rephrasing of the previous material.

WARNINGS, CAUTIONS, AND NOTES

The following definitions apply to "WARNINGS," "CAUTIONS," and "NOTES" found through the manual.

WARNING

An operating procedure, practice, or condition, etc., which may result in injury or death, if not carefully observed or followed.

CAUTION

An operating procedure, practice, or condition, etc., which, if not strictly observed, may damage equipment.

Note

An operating procedure, practice, or condition, etc., which is essential to emphasize.

WORDING

The concept of word usage and intended meaning which has been adhered to in preparing this Manual is as follows:

"Shall" has been used only when application of a procedure is mandatory.

"Should" has been used only when application of a procedure is recommended.

"May" and "need not" have been used only when application of a procedure is optional.

"Will" has been used only to indicate futurity, never to indicate any degree of requirement for application of a procedure.

NATOPS/TACTICAL CHANGE RECOMMENDATION
OPNAV FORM 3500/22 (5-69) 0107-722-2002

DATE

TO BE FILLED IN BY ORIGINATOR AND FORWARDED TO MODEL MANAGER

FROM (originator)	Unit
TO (Model Manager)	Unit

Complete Name of Manual/Checklist	Revision Date	Change Date	Section/Chapter	Page	Paragraph

Recommendation (be specific)

☐ CHECK IF CONTINUED ON BACK

SAMPLE

Justification

Signature	Rank	Title

Address of Unit or Command

TO BE FILLED IN BY MODEL MANAGER *(Return to Originator)*

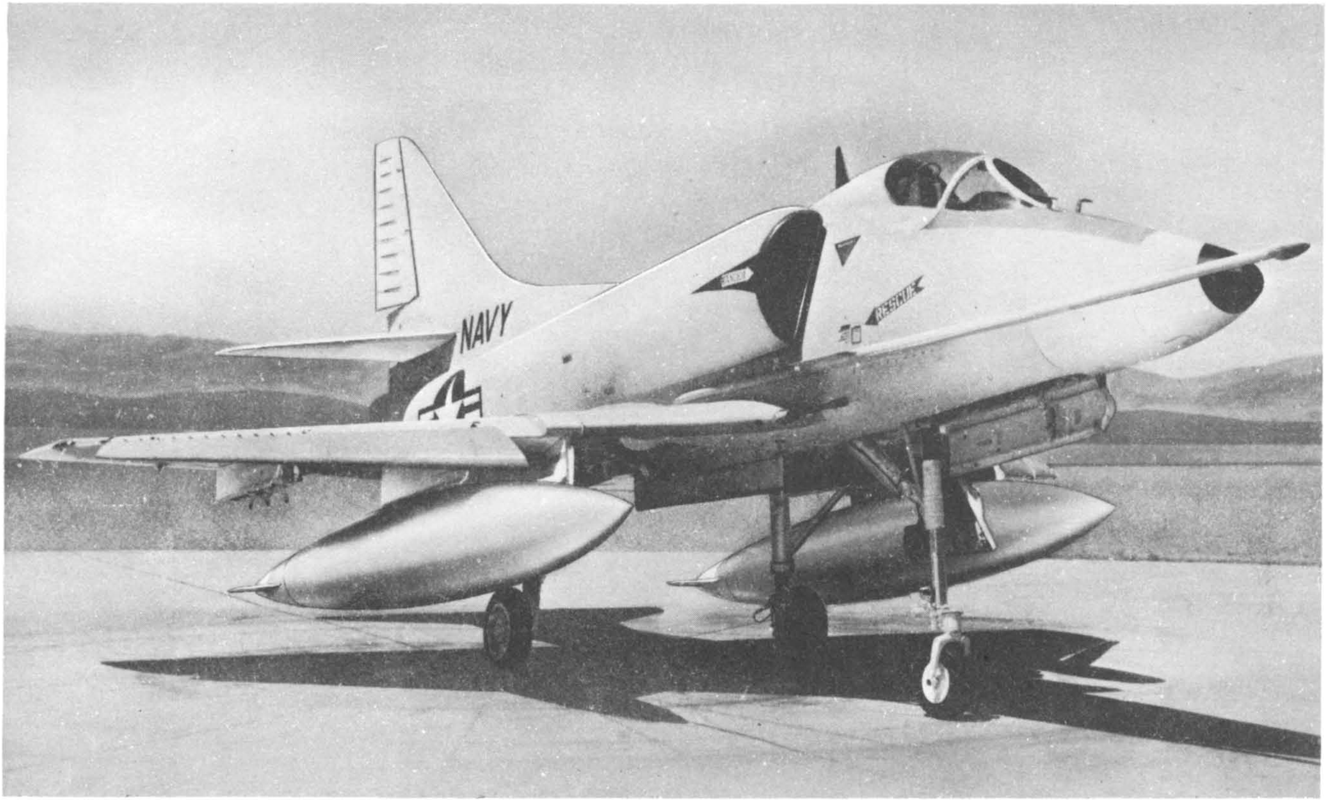
FROM	DATE
TO	

REFERENCE
(a) Your Change Recommendation Dated ____________

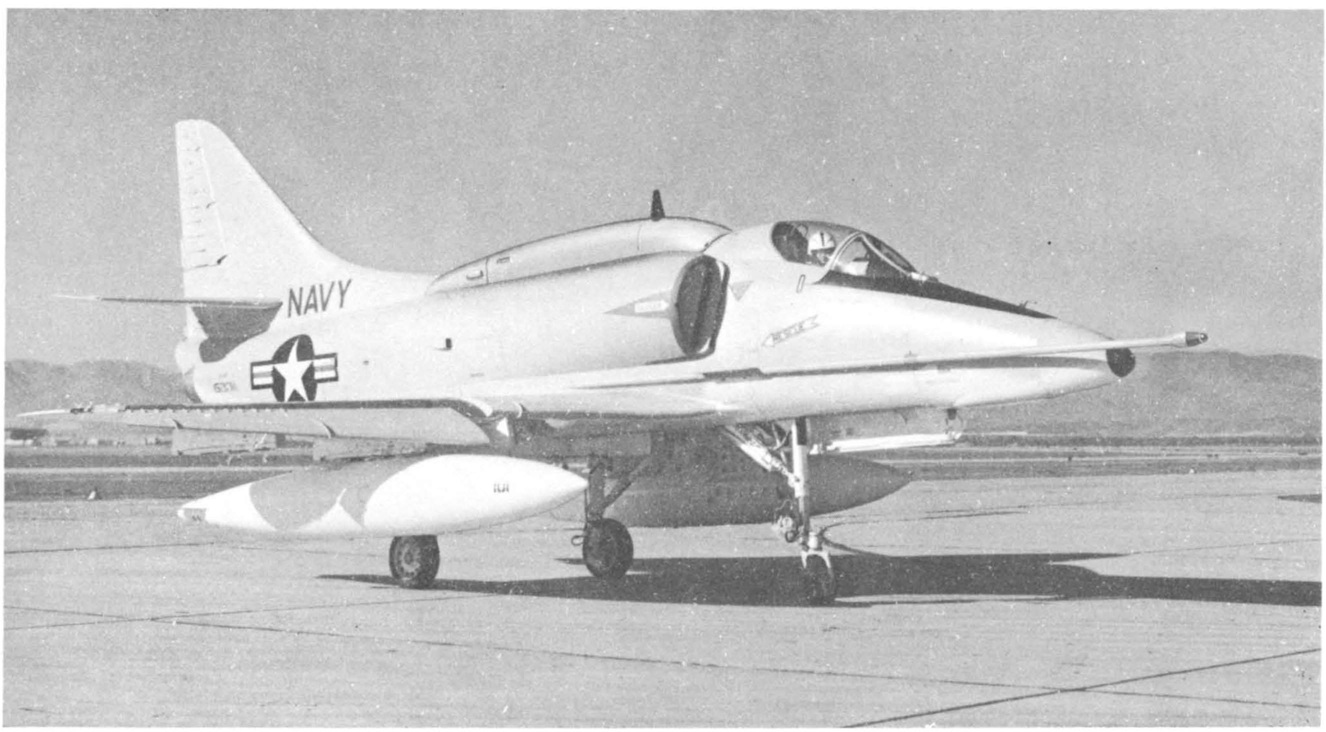
☐ Your change recommendation dated ________ is acknowledged. It will be held for action of the review conference planned for ____________ to be held at ____________

☐ Your change recommendation is reclassified URGENT and forwarded for approval to ____________ ____________ by my DTG ____________

/S/ ____________ MODEL MANAGER ____________ AIRCRAFT



A-4E



A-4F

GG1-55

Figure 1-1. Model A-4E/A-4F Aircraft

SECTION I
THE AIRCRAFT

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PART 1

GENERAL DESCRIPTION

DESCRIPTION

The Navy Model A-4E/F Skyhawk (figure 1-1) is a single-place monoplane with a modified delta-planform wing manufactured by the McDonnell Douglas Aircraft Company, Aircraft Division, Long Beach, California. It is powered by either a P&WA J52-P-6A gas turbine engine producing a sea-level static thrust rating of 8500 pounds, or a P&WA J52-P-8A engine producing a sea-level static thrust rating of 9300 pounds. Designed as a high performance lightweight attack aircraft, it mounts two 20-mm guns internally, carries a variety of external stores, and is capable of operating either from a carrier of from a shore base. The basic weight of the A-4E/F should be determined from the particular aircraft's Handbook of Weight and Balance as this weight may vary as much as 500 pounds depending upon service change configuration. Refer to figure 11-1 for aircraft weights.

Figures 1-2 through 1-7 show the principal dimensions, major airframe components, cockpit general arrangement, and main differences table. Cockpit instrument panels and consoles are shown in figures FO-1 and FO-2.

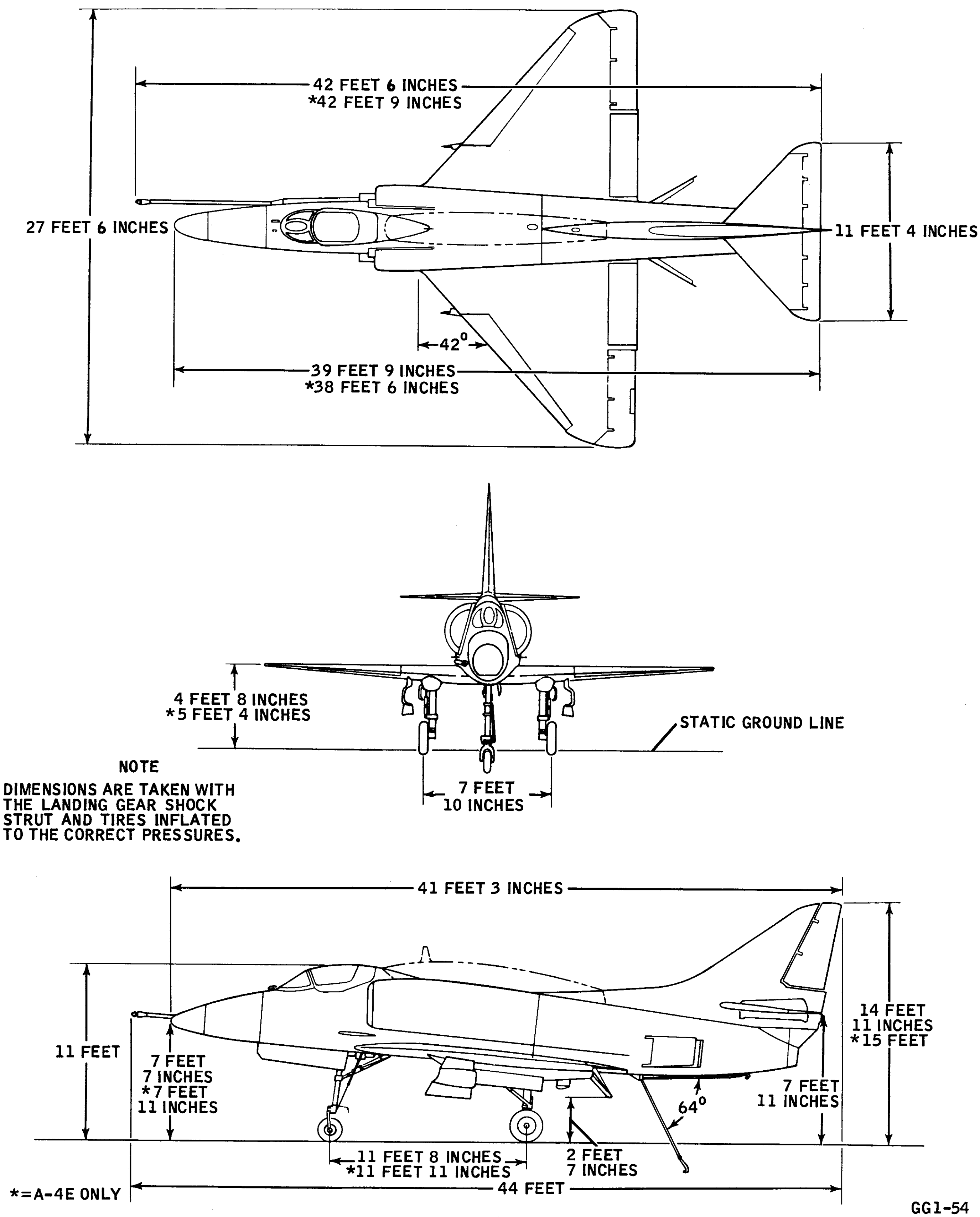


Figure 1-2. Principal Dimensions

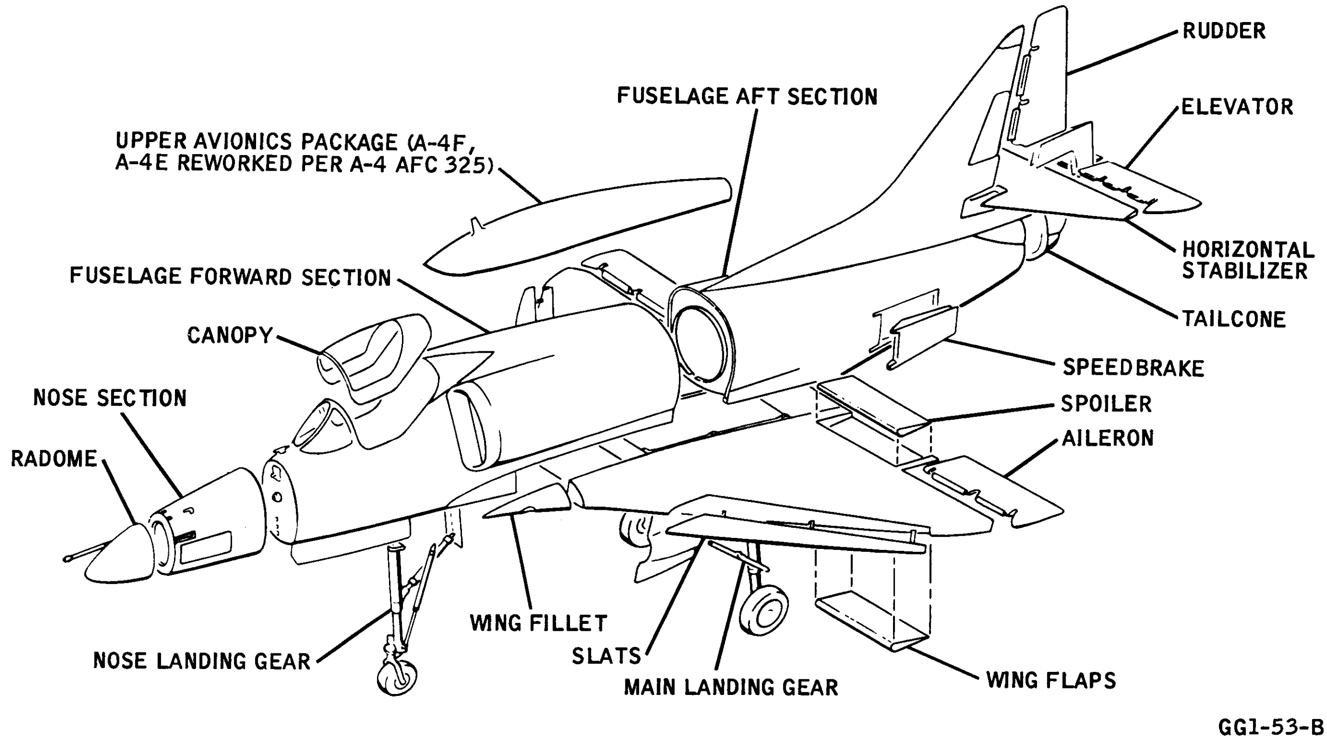


Figure 1-3. Airframe Major Components

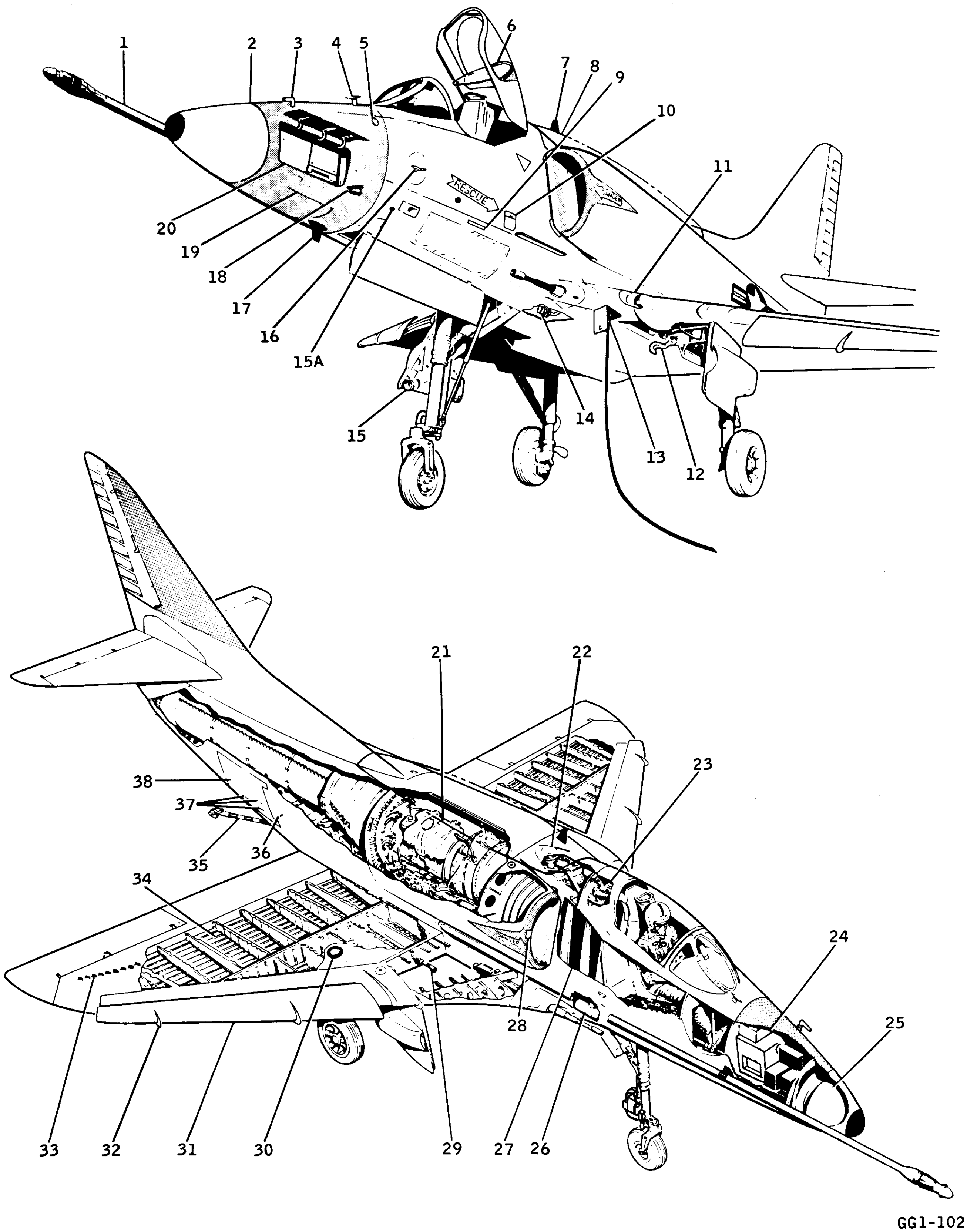


Figure 1-4. General Arrangements

Key to figure 1-4

1. Air refueling probe
2. Radome
3. Pitot tube
4. Total temperature sensor
5. Brake fluid level window
6. Thermal radiation closure
7. AN/ARC-51A (UHF) or AN/ARC-27A (UHF) radio antenna
8. Upper avionics package
9. Normal cockpit entry handle
10. External canopy-jettison handle
11. Approach lights
12. Catapult hook
13. External power receptacle and access door
14. Oil tank pressure filler cap
15. Taxilight
15A. Engine bleed static port
16. Angle-of-attack vane and transducer
17. AN/ARN-52(V) or AN/ARN-21B TACAN antenna
18. Pitot static orifice
19. AN/ARA-50 or AN/ARA-25 (UHF-ADF) antenna cover
20. Nose compartment access door
21. Oil tank
22. Fuselage fuel tank filler cap
23. Cockpit canopy air bungee cylinder
24. Nose section electronic equipment compartment
25. AN/APG-53A/B radar transmitter and receiver group
26. Emergency generator
27. Fuselage fuel tank
28. Air refueling probe light
29. Catapult hook
30. Wing tank filler cap
31. Slat
32. Barricade engagement detent
33. Vortex generators
34. Integral wing fuel tank
35. Arresting hook
36. JATO igniter terminal
37. JATO mounting hooks
38. Speedbrake

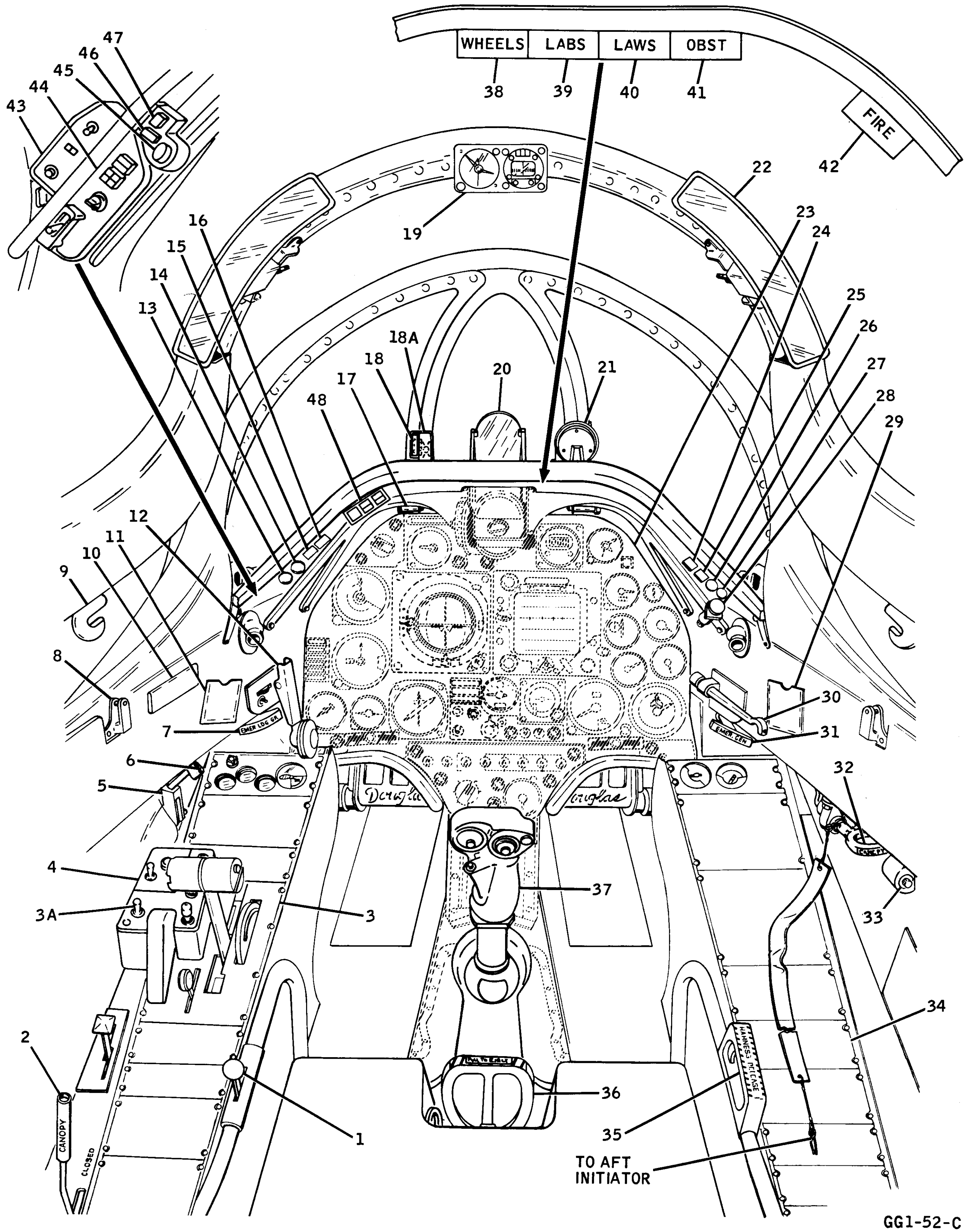
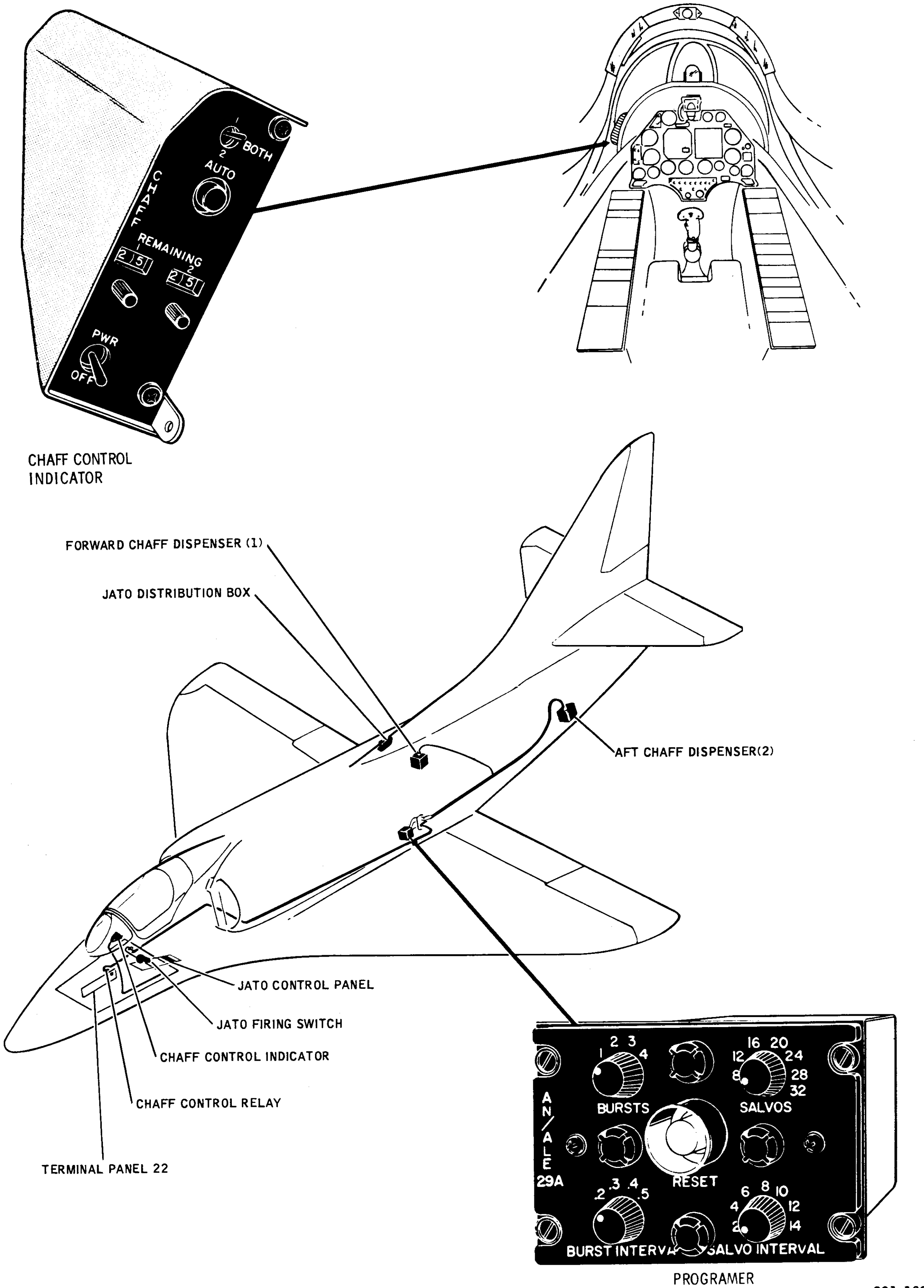


Figure 1-5. A-4E General Arrangement – Cockpit

Key to figure 1-5

1. Shoulder harness control handle
2. Manual canopy control handle
3. Left console (figure FO-1)
3A. Spoiler ARM-OFF switch
4. APC-JATO control panel
5. Catapult handgrip
6. JATO firing button
7. Emergency landing gear release handle
8. Canopy latch rollers
9. Canopy latch hooks
10. Compass deviation card
11. Compass correction card
12. Landing gear control handle
13. Left turn light
14. Marker beacon light (low altitude warning system (LAWS) light) (All A-4E aircraft reworked per A-4 AFC 333)
15. LABS light
16. WHEELS warning light
17. Cockpit floodlights
18. APC status light
18A. Angle-of-attack indexer lights
19. Standby compass and elapsed time clock
20. Gunsight
21. Remote channel indicator
22. Rear view mirror
23. Instrument panel (figure FO-1)
24. FIRE warning light
25. OBST warning light
26. ARM/ORD light
27. Right turn light
28. Utility floodlight
29. Standby compass deviation card
30. Arresting hook handle
31. Emergency generator release handle
32. Canopy jettison handle
33. White floodlights control
34. Right console (figure FO-1)
35. Harness release handle
36. Alternate ejection handle
37. Control stick
38. WHEELS warning light (all A-4E aircraft reworked per AFC 394)
39. LABS light (all A-4E aircraft reworked per AFC 394)
40. LAWS light (all A-4E aircraft reworked per AFC 394)
41. OBST warning light (all A-4E aircraft reworked per AFC 394)
42. FIRE warning light (all A-4E aircraft reworked per AFC 394)
43. Chaff control panel (all A-4E aircraft reworked per AFC 325; refer to NAVAIR 01-40AV-1T(A), A-4/TA-4 Tactical Manual Supplement).
44. ECM control panel (all A-4E aircraft reworked per AFC 325; refer to NAVAIR 01-40AV-1T(A), A-4/TA-4 Tactical Manual Supplement).
45. LAWS light (all A-4E aircraft reworked per AFC 325)
46. LABS light (all A-4E aircraft reworked per AFC 325)
47. WHEELS light (all A-4E aircraft reworked per AFC 325)
48. Threat warning light panel (all A-4E aircraft reworked per AFC 394)



Effectivity: A-4E/F aircraft reworked per A-4 AFC 418-II

Figure 1-5A. AN/ALE-29A Chaff Dispensing System

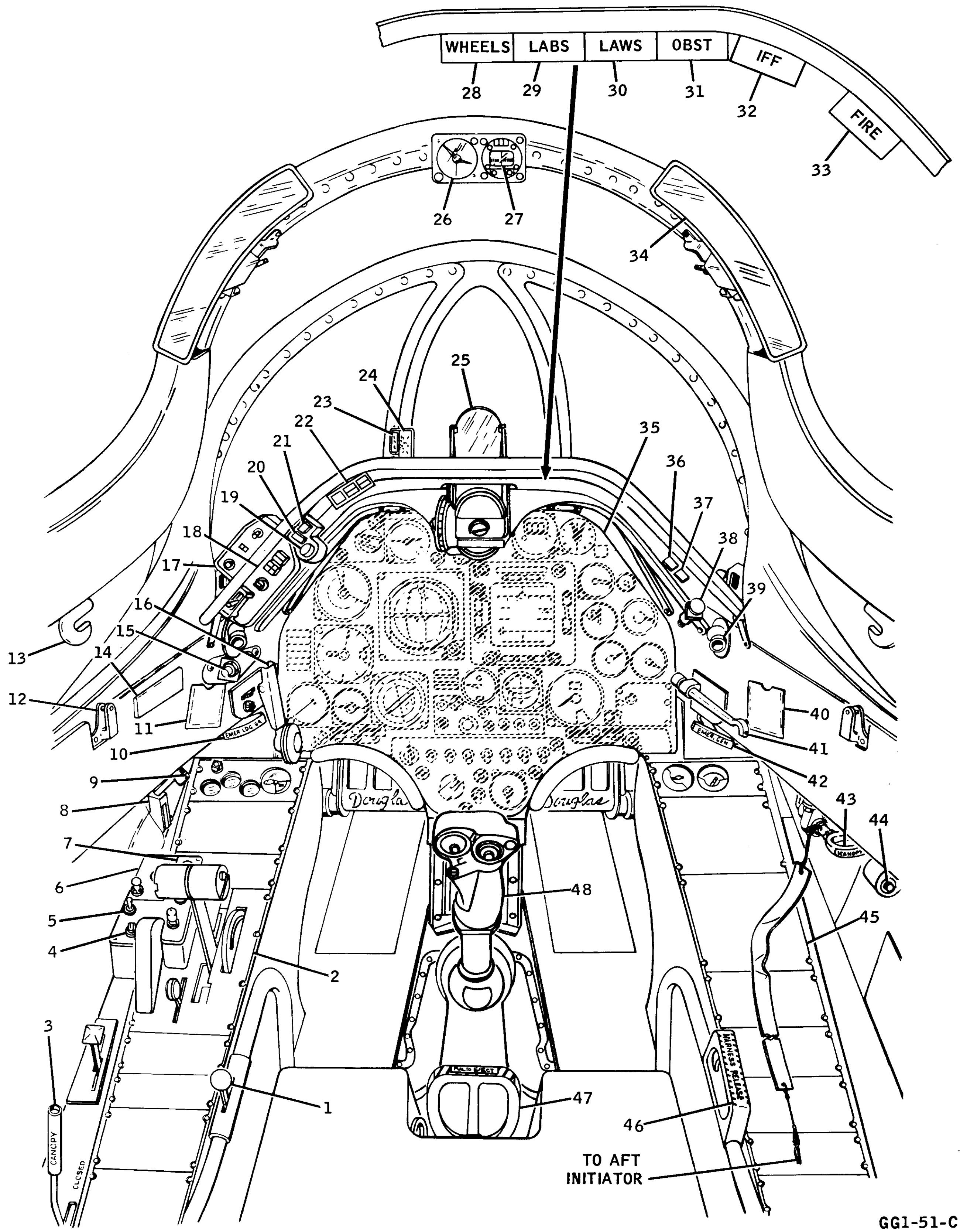


Figure 1-6. A-4F General Arrangement – Cockpit

Key to figure 1-6

1. Shoulder harness control handle
2. Left console (figure FO-2)
3. Manual canopy control handle
4. Spoiler ARM-OFF switch
5. Nosewheel steering switch
6. APC control panel
7. JATO control panel
8. Catapult handgrip
9. JATO firing button
10. Emergency landing gear release handle
11. Compass correction card
12. Canopy latch rollers
13. Canopy latch hooks
14. Compass deviation card
15. Rain repellent button
16. Landing gear handle
17. Chaff control panel (A-4F aircraft reworked per AFC 325-III. Refer to NAVAIR 01-40AV-1T(A), A-4/TA-4 Tactical Manual Supplement)
18. ECM control panel (A-4F aircraft reworked per AFC 325. Refer to NAVAIR 01-40AV-1T(A), A-4/TA-4 Tactical Manual Supplement)
19. Low altitude warning light (LAWS)
20. Low altitude bombing system light (LABS)
21. WHEELS warning light
22. Threat warning light panel (A-4F aircraft reworked per AFC 394-III)
23. APC status light
24. Angle-of-attack indexer
25. Gunsight
26. Elapsed time clock
27. Standby compass
28. WHEELS warning light (A-4F aircraft reworked per AFC 356)
29. LABS light (A-4F aircraft reworked per AFC 356)
30. LAWS light (A-4F aircraft reworked per AFC 356)
31. OBST warning light (A-4F aircraft reworked per AFC 356)
32. IFF MODE 4 failure light (A-4F aircraft reworked per AFC 356)
33. FIRE warning light (A-4F aircraft reworked per AFC 356)
34. Rear view mirror
35. Instrument panel (figure FO-2)
36. FIRE warning light
37. OBST warning light
38. Utility floodlight
39. Eyeball diffuser
40. Standby compass deviation card
41. Arresting hook handle
42. Emergency generator release handle
43. Canopy jettison handle
44. White floodlights control
45. Right console (figure FO-2)
46. Harness release handle
47. Alternate ejection handle
48. Control stick

	A-4A	A-4B	A-4C	A-4E	A-4F	TA-4F
Engine	J65-W-16A	J65-W-16A J65-W-20	J65-W-16A J65-W-20	J52-P-6A J52-P-8A	J52-P-8A	J52-P-6A J52-P-8A
Fuselage						
Fueling Probe	NO	YES	YES	YES	YES	YES
Air Refueling Store	NO	YES	YES	YES	YES	YES
Intake Ducts	FLUSH	FLUSH	FLUSH	SEPARATED	SEPARATED	SEPARATED
Upper Avionics Compartment	NO	NO	NO	SOME	YES	NO
AFCS	NO	NO	YES	YES	YES	YES
Approach Power Compensator	NO	NO	YES	YES	YES	YES
Radar	NO	NO	AN/APG-53A	AN/APG-53A AN/APG-53B	AN/APG-53A AN/APG-53B	AN/APG-53A AN/APG-53B
Radar Beacon	NO	NO	AN/APN-154(V)	AN/APN-154(V)	AN/APN-154(V)	NO
AN/ALE-29A Chaff Dispenser	NO	YES	YES	YES	YES	NO
Video IP-936/AXQ	NO	NO	NO	SOME	SOME	SOME
Navigation Computer	NO	ASN-19	ASN-19	ASN-19 ASN-41	ASN-41	ASN-41
LABS	AERO 18B	AERO 18B	AN/AJB-3	AN/AJB-3 AN/AJB-3A	AN/AJB-3A	AN/AJB-3A
Bombing Computer	NONE	NONE	CP-841/A	CP-741/A	CP-741/A	CP-741/A
Oxygen System	5 LITER	5 LITER	10 LITER	10 LITER	10 LITER	10 LITER
Extendable Control Stick	YES	YES	NO	NO	NO	NO
Fuel Gaging						
Fuselage	1 PROBE	1 PROBE	1 PROBE	1 PROBE	1 PROBE	1 PROBE
Wing	2 PROBE	2 PROBE	6 PROBE	6 PROBE	6 PROBE	6 PROBE
Drop Tanks	YES	YES	YES	YES	YES	YES
Fuselage Fuel Cell Capacity	1600 LB	1600 LB	1600 LB	1600 LB	1600 LB	700 LB
Elevator						
Boosted	YES	NO	NO	NO	NO	NO
Powered	NO	YES	YES	YES	YES	YES
Aileron Power	SINGLE	TANDEM	TANDEM	TANDEM	TANDEM	TANDEM
Stabilizer Trim						
12 Degrees Noseup 1 Degree Nosedown	YES	NO	NO	NO	NO	NO
11 Degrees Noseup 1 Degree Nosedown	NO	YES	YES	NO	NO	NO
12 1/4 Degrees Noseup 1 Degree Nosedown	NO	NO	NO	YES	YES	YES
Bomb Racks	3	3	3	5	5	5
Rocket Ejection Seat	ESCAPAC 1	ESCAPAC 1	ESCAPAC 1 STENCEL MOD	ESCAPAC 1 STENCEL MOD	ESCAPAC 1C-3	ESCAPAC 1C-3
Nosewheel Steering	NO	NO	NO	NO	YES	YES
Spoilers	NO	NO	NO	YES*	YES	YES

*A-4E reworked per AFC 442.

Figure 1-7. Main Differences

PART 2
SYSTEMS

ENGINE

The P&WA J52-P-6A/B or J52-P-8A/B turbojet is a continuous-flow gas turbine engine, utilizing a split 12-stage axial compressor. The five-stage low-pressure unit is connected by a through shaft to the second-stage turbine rotor. The seven-stage high-pressure unit is connected independently by a hollow shaft to the first-stage turbine rotor. The rpm of the high-pressure rotor (N_2) is governed by the engine fuel control, whereas the low-pressure rotor rpm (N_1) is completely independent and is entirely a function of the pressure drop across the turbines. There are nine combustion chambers (No. 1 at the top). No. 4 and 7 have spark igniters.

The J52-P-6A/B engine, in a static condition, standard atmospheric day at sea level, develops 8500 pounds of thrust.

The J52-P-8A/B engine, in a static condition, standard atmospheric day at sea level, develops 9300 pounds of thrust.

Also included as part of the engine is the anti-icing air system, compressor airbleed system, cooling air system, internal airbleed system, lubrication system, pressure oil system, scavenge oil system, oil breather system, fuel system, ignition system, and fuel heater.

Compressor Airbleed System

The compressor airbleed system vents low-pressure compressor unit air overboard as necessary to prevent overloading the high-pressure compressor unit.

CAUTION

Covering or clogging engine bleed static port on left side of forward fuselage can cause compressor chugs and stalls and loss of thrust.

Ignition

Effectivity: All A-4E with J52-P-6A/B engines.

The engine ignition system consists of two spark igniters, an ignition timer, and dual (20-joule and 4-joule) ignition units. The spark igniters are located in the two combustion chambers at the 4 and 8 o'clock positions. For engine starting, the timer energizes the high-power ignition unit supplying 20 joules to both igniters for a 30- to 45-second firing cycle. Whenever the engine-driven or emergency generator is operating, the 4-joule ignition system operates continuously, firing only the igniter that is located at the 4 o'clock position. The ignition switch, which energizes the ignition timer, is a momentary-contact limit switch that is actuated by movement of the throttle outboard from the OFF position.

NOTE

Even though the 4-joule system operates continuously, conditions of fuel-air mixture would have to be ideal to relight from this system.

Ignition

Effectivity: All A-4F; all A-4E with J52-P-8A/B engines.

The engine ignition system consists of two spark igniters, an ignition timer, and dual (20-joule) ignition units. The spark igniters are located in the two combustion chambers at the 4 and 8 o'clock positions. For engine starting, the timer energizes the high-power ignition unit supplying 20 joules to both igniters for a 30- to 45-second firing cycle. The ignition switch, which energizes the ignition timer, is a momentary-contact limit switch that is actuated by movement of the throttle outboard from the OFF position.

Starter

The engine is started on the ground by a pneumatic starter driven by compressed air from a mobile gas turbine compressor (GTC). The compressor can be carried externally on the centerline or inboard store racks. (When the GTC unit is carried on the centerline store rack, a carrier landing is permitted. With the GTC unit installed on either inboard store rack, carrier landing is not permitted and the flight limitations as set forth in part 4 of this section, must be complied with.)

Engine Fuel System

The function of the engine fuel system is to supply and regulate the fuel to the combustion chambers at pressures and flows required by engine air flow at all operating altitudes and temperatures. The system has two major components: the engine fuel pump and the fuel control.

ENGINE FUEL PUMP

The engine fuel pump consists of a centrifugal booster stage and a high-pressure single gear stage with a 40-micron filter between the two. A filter bypass, a pressure relief valve, and a vapor return to the fuselage fuel cell are also incorporated.

FUEL CONTROL

The engine fuel control is a hydromechanical control that senses inlet air temperature, burner pressure, high-pressure compressor speed (N_2), and throttle position. When the throttle setting is changed and while accommodating to a new steady-state fuel rate, the fuel control varies the fuel flow between the limiting values established by safe tailpipe temperature and mixture combustibility. The control permits the fuel flow to reach these limits during acceleration and deceleration but does not permit transgression in either direction, thus preventing compressor stalls, excessive temperatures, or flameouts. The fuel control compensates automatically only for variations in altitude and airspeed when in MANUAL.

The engine fuel control operation may be changed from PRIMARY to MANUAL at all altitudes during flight. If airspeed at the time of switchover is above 225 KIAS, selection of MANUAL may be made at any throttle setting from IDLE to MILITARY. If airspeed is below 225 KIAS, select a minimum throttle setting of 65 percent rpm prior to switchover.

NOTE

During flight testing, it has been demonstrated that the manual fuel control position can be safely selected while at MILITARY up to 30, 000 feet.

The switchover to the manual fuel system may be accompanied by a minor surge in engine speed and EGT.

After a switchover, the throttle should be moved slowly and smoothly to the desired power setting. Observe the engine operating limitations given in part 4 of this section. It must be remembered that when operating on the manual fuel control system, all fuel metering to the engine is accomplished by direct movement of the throttle; therefore, all power changes must be made with care, not only to prevent overspeeding and extreme temperatures, but also to avoid a flameout from the possible inability of the engine to parallel in speed the rapidly changing fuel flow during quick accelerations and decelerations.

NOTE

Complete loss of electrical power precludes switching the fuel control from the position selected.

Engine Controls

THROTTLE

The throttle (figures FO-1 and FO-2) located on the left console is mechanically linked to the engine fuel control unit and is the means of selecting engine thrust. Marked positions of the throttle are OFF, IGN (ignition), IDLE, NORMAL, and MILITARY. The OFF position closes a fuel cutoff valve in the fuel control unit stopping all fuel flow to the engine fuel nozzles. The IGN position actuates the ignition timer when the throttle is moved outboard from the OFF position. The IDLE position has a detent to prevent inadvertent movement of the throttle to the OFF position. The NORMAL position indicates the operating range of the engine. At MILITARY the engine should develop maximum thrust and rpm, which will vary with atmospheric conditions. Switches for the radio microphone and speedbrakes are located on the inboard side of the throttle grip, with the exterior lights master switch on the outboard side. Inboard of the throttle, on the console, is the throttle friction wheel. The friction wheel is rotated forward to increase friction on the throttle. To prevent retarding the throttle during catapulting, a catapult handgrip (figures 1-5 and 1-6), which extends from its spring-loaded position against the cockpit rail, is grasped in conjunction with the throttle. The JATO firing button is incorporated in the catapult handgrip.

ENGINE CONTROL PANEL

The engine control panel, just aft of the throttle, contains all other controls for the operation of the engine. On the panel are the manual fuel control warning light, the drop tanks pressurization and flight refuel switch, the air refueling fuselage-only switch, the emergency transfer and wing fuel dump switch, the engine starter switch, and the fuel control switch.

FUEL CONTROL SWITCH. A two-position fuel control switch on the engine control panel (figures FO-1 and FO-2) is used to select the mode of operation of the engine fuel control unit. With the switch at PRIM, the automatic metering devices in the fuel control unit regulate the flow of fuel to the engine as described above. The control compensates automatically for variations in altitude and airspeed only when the switch is in MANUAL.

MANUAL FUEL CONTROL WARNING LIGHT. The manual fuel control warning light located on the engine control panel comes on when the fuel control

has shifted to the manual mode of operation. The light indicates the position of the emergency transfer valve which directs the fuel to either the primary or manual fuel control system. The emergency transfer valve is kept in the manual fuel control position by spring load until overcome by engine-driven fuel pump pressure, regardless of the position of the fuel control switch. Consequently, the light will be on during normal engine starts until fuel pressure within the control shifts the transfer valve to the PRIMARY position at approximately 5 to 10 percent rpm. The light will also come on shortly after engine shutdown indicating a shift to the MANUAL mode upon loss of fuel pressure. With normal fuel pressure, the position of the emergency transfer valve and the mode of fuel control will always correspond to the position of the fuel control switch.

ENGINE STARTER SWITCH. Actuation of the starter is controlled by the engine starter switch on the engine control panel (figures FO-1 and FO-2), and is labeled START-ABORT. When the switch is depressed to START, the starter air supply solenoid valve opens, allowing compressed air from the gas turbine compressor to rotate the starter. A holding relay retains the switch in the START position. When engine speed reaches approximately 50 percent rpm, a centrifugal switch opens, allowing the engine starter switch to pop up, thus stopping the air supply to the starter. Manually pulling out the engine starter switch will also stop the starter air supply.

Approach Power Compensator

The approach power compensator (APC) system is installed in aircraft reworked per A-4 AFC 268-I-II-III. The APC controls the fuel control and is designed to maintain the optimum angle of attack of 17.5 units resulting in an optimum approach speed on the glide slope and during normal maneuvers in the landing pattern at any landing gross weight. Major APC components are the computer, amplifier, servo actuator, accelerometer, elevator potentiometer, angle-of-attack vane transducer, and the APC control panel.

The APC is designed to command throttle position between an approximate 70 percent rpm and an approximate military rated thrust (MTR) in response to angle of attack. The angle-of-attack signal is modified by normal acceleration and elevator control stick position. If the APC is engaged or operating when aircraft angles of attack are greater than or less than optimum, the APC will compensate by increasing or decreasing throttle position accordingly. At angles of attack greater than optimum, the APC will command an increasing throttle position until MRT (approximate) is attained or the angle of attack returns to optimum. Conversely, at angles of attack less than optimum, the APC will command a decreasing throttle position until 70 percent (approximate) rpm is attained or the angle of attack returns to optimum.

When the APC is in operation (power switch – ENGAGE), the system will disengage if any of the following occurs:

1. Throttle friction is applied.

2. Throttle position is below 70 percent (approximate) rpm.

3. Weight is applied to the main landing gear.

NOTE

It is possible to manually hold the APC engaged and override features 1, 2, and 3.

4. An override force of 25 to 30 pounds is applied to the throttles.

5. Power switch is manually returned to STBY position.

APC CONTROL PANEL

The APC control panel is located outboard of the throttle on the left console (figures FO-1 and FO-2). The control panel contains two 3-position switches: an APC power switch and an air temperature switch.

APC POWER SWITCH

The APC power switch, labeled OFF, STBY, and ENGAGE, controls electrical power to the APC system. When the switch is in the OFF position, the APC is deenergized. Placing the switch in STBY position energizes the APC but does not engage the system. After the power switch has been positioned in STBY for a minimum of 15 seconds, and the status light (located on the AOA indexer) comes on, the APC will function when the power switch is placed in the ENGAGE position.

AIR TEMPERATURE SWITCH

The air temperature switch, labeled HOT, STD (standard), and COLD, provides a means of compensating for variation in thrust due to outside air temperature changes. The HOT position should be used for temperatures above 80°F (27°C), STD, from 40° to 80°F (5 to 27°C); and COLD, below 40°F (5°C).

APC STATUS LIGHT

APC system status is indicated to the pilot by the APC status light attached to the AOA indexer above the instrument glareshield. The light comes on

when the system is in STBY and goes off when the APC is engaged. The light comes on when the system is disengaged and/or is returned to STBY.

Engine Instruments

EXHAUST GAS TEMPERATURE (EGT) INDICATOR

The exhaust gas temperature indicator (figures FO-1 and FO-2), located on the instrument panel, indicates the temperature of the exhaust gases immediately downstream of the turbine assembly in degrees centigrade. The range of indications is from 0° to 1000°C.

NOTE

High rates of roll or positive and negative accelerations may cause the EGT indicator to give erroneous indications. However, upon return to stabilized flight, readings return to normal.

TACHOMETER

A tachometer (figures FO-1 and FO-2), located on the instrument panel, indicates the speed of the high-pressure compressor rotor (N_2) as a percentage of 12,052 rpm (J52-P-8A/B) or 11,600 rpm (J52-P-6A/B). Both EGT indicator and tachometer operate independently of aircraft electrical power and function whenever the engine is running.

PRESSURE RATIO INDICATOR

A pressure ratio indicator (figures FO-1 and FO-2), located on the instrument panel, is provided to indicate the ratio of tailpipe pressure to pressure at the pitot tube as a means of checking takeoff thrust at military power. The instrument is calibrated from 1.2 to 3.4. A knob on the lower left-hand side of the instrument operates a counter dial and simultaneously moves an index pointer that travels along the perimeter of the index face. The knob is turned until the minimum acceptable takeoff pressure ratio is displayed on the counter dial. (See figure 3-3 to determine the minimum acceptable takeoff pressure ratio.) When the throttle is advanced to MILITARY power, a needle on the dial should coincide with, or exceed, the setting of the index pointer to indicate that minimum acceptable takeoff thrust is available and should be read at zero airspeed. The pressure ratio indicator reflects a direct measurement of the engine thrust output and is recommended as the primary cruise control variable when selecting engine thrust output to establish cruise schedules.

NOTE

Wind has a negligible effect on EPR readings.

FUEL FLOWMETER

A fuel flowmeter indicator (figures FO-1 and FO-2), located on the instrument panel, shows engine fuel consumption in pounds per hour. The portion of the dial between 300 to 5000 pounds per hour is divided into 100-pound increments. Above 5000 pounds per hour, the dial is marked into 1000-pound increments. Flow rates between 0 and 300 pounds per hour will be indicated as 300 pounds per hour. The fuel flowmeter indicator, because of engine tolerances and overhaul life, does not accurately measure engine thrust output. It should be used only as a secondary indication when establishing cruise schedules.

Engine Operation

The control of the engine consists essentially of selecting throttle positions. If the engine is in trim, the pressure ratio indicator will reflect any thrust setting (operating condition) that the pilot selects with the throttle. Exhaust gas temperature indicates how much work the engine should be, or is, doing. Therefore, EGT must never be used as a basis for setting thrust, except when it becomes necessary to reduce a throttle setting to avoid exceeding a temperature limit, or to cope with unstable operation.

The pilot must not only know and observe the engine operating limitations specified in part 4 of this section, he must also recognize relationships like those between operating temperatures and temperature limits. For example, although it is permissible for an engine to operate at the actual temperature limit corresponding to a selected thrust setting (operating condition), an engine that does so may have something wrong that causes it to run abnormally hot. Also, it is the thrust setting, not the EGT indication, that determines the allowable time limit specified in part 4. That is, the time limit is 30 minutes because the thrust setting is Military Rated – not because the EGT indication happens to be 610°C (J52-P-6A), 621°C (J52-P-6B) or 650°C (J52-P-8A/B). Report as an engine discrepancy every instance of

overtemperature, noting not only the peak temperature reached, but also the length of time that the EGT exceeded limits.

NOTE

Under conditions of severe rainfall, maintain a minimum engine power setting of 70 percent rpm. This will assure adequate acceleration margin and prevent possible speed hangups.

STARTING

Engine exhaust gas temperature will not normally rise above 350°C on ground start. However, conditions may exist that will give rise to EGT, which may approach the maximum permissible of 455°C. Under these conditions, the EGT tendency will be a better indication of proper engine operation than will the actual value attained. Thus, a ground starting EGT of 400°C and rising rapidly should concern a pilot more than a start where the EGT slowly peaks out at 450°C. The cause of the start above 350°C (extremely high ambient temperatures, starting a hot engine, high wind up the tailpipe, etc.) should always be determined as start EGT may be indicative of some engine malfunction. Refer to section V for abnormal starts.

ACCELERATION

The acceleration temperature limits are specified in part 4 of this section. These limits apply to all accelerations whether from IDLE to MILITARY thrust or only a small change such as from 85 to 90 percent rpm. The limit for acceleration and maximum operating temperature should be interpreted to mean that the EGT may rise to the acceleration limit during or immediately following the acceleration, but must decrease to the MILITARY EGT limit or less within 8 minutes after the engine reaches its speed.

STEADY STATE OPERATION

Exhaust gas temperatures given in part 4 of this section for Normal Rated should be thought of as the temperature which, if exceeded at approximately 3 percent less than MILITARY rpm, warns of a possible engine malfunction. The temperatures shown for Military Rated and Normal Rated are positive limits that can not be exceeded without compromising the engine's service life. A normally functioning engine should operate somewhat below the EGT limits published for the several operating conditions. The IDLE EGT limit is intended only as a guide, and is not a firm operating limit.

Specified temperature limits serve two purposes: They assure that an engine will always be operated at internal temperatures that will not shorten the service life expectancy of engine components; they enable the pilot to detect an engine fuel control system or instrumentation malfunction in time to take proper corrective action.

The length of time that an engine may be operated at each of the thrust settings (operating conditions) was established to conserve the life of the engine and to make the time between overhauls predictable.

An engine's service life budget has just so many hours of operation at high thrust. Whether these hours are used up quickly or are distributed throughout a normal, calculated period depends on how conscientiously the EGT and time limits are observed by the pilot.

The time limit for operation at Military Rated is specified not so much to permit a cooling period between intervals of operation at high thrust as it is to distribute the rate of blade creep throughout the engine's normal life. Nothing is gained, therefore, by reducing a high thrust setting only momentarily before repeating it – just to be able to report that time limits were not violated.

In the high thrust range, an increase of only 50°C may double the rate of turbine blade creep. Just so much creep can be tolerated by each blade. The rate at which blade life is depleted depends on proper pilot technique. Unfortunately, no operational technique can reverse the effect of blade creep.

Engine Exhaust Smoke Abatement System

Aircraft reworked A-4 AFC 382 provide an engine exhaust smoke abatement system. When the system is activated a fuel additive fluid is mixed with engine fuel to reduce engine tailpipe smoke emission for tactical purposes.

The system is controlled by the smoke abatement switch, located on the left console (figures FO-1 and FO-2). Switch positions are marked FUEL ADD and OFF. When the switch is placed in the FUEL ADD position, a solenoid air valve permits pressure-regulated engine bleed air to expand a bladder in the fuel additive tank, forcing the fuel additive fluid through a fuel additive solenoid shutoff valve (open when in the FUEL ADD position) and into the fuel engine supply (see figures FO-3 and FO-4). The additive flow rate will vary with engine fuel flow, thereby maintaining a percentage of concentration that is

nearly constant. The fuel additive tank is pressure filled from an external ground source.

OIL SYSTEM

The engine lubrication system is a self-contained, high-pressure system which supplies lubrication to the main engine bearings and to the accessory drives. Oil delivered by the engine-driven oil pump is cooled by means of an oil cooler prior to entering the bearing compartments. The oil cooler is a heat exchanger, employing the fuel flowing to the engine as a coolant. A scavenge system returns oil withdrawn from the bearing compartments and the accessory drive gearbox to the oil tank. A breather system connects the individual bearing compartments and oil tank with the breather pressure relief valve. The breather pressure relief valve vents overboard on the starboard side of the aft fuselage. See figure 1-27 for oil tank capacity and oil specification. The maximum oil consumption is 0.28 gallons (approximately 1 quart) per hour.

Oil Pressure Indicator

Engine oil pressure is shown on the oil pressure indicator (figures FO-1 and FO-2) on the instrument panel. Normal oil pressure is 40 to 50 psi. Minimum oil pressure for ground IDLE is 35 psi.

NOTE

- Maneuvers producing acceleration near zero "g" may cause a temporary loss of oil pressure. Absence of oil pressure for a maximum of 10 seconds is permissible.
- Oil pressure indications are available on emergency generator.

Oil Quantity Indicator/Switch

Effectivity: All A-4F; all A-4E reworked per A-4 AFC 315.

An oil quantity indicator/switch, labeled OIL LOW, is mounted in the upper right-hand side of the pilot's instrument panel (figures FO-1 and FO-2). The OIL LOW indicator light automatically comes on when the engine oil tank reaches a critically low engine oil level of 20 percent or less of capacity. Oil servicing is required if pressing the switch causes the OIL LOW light to come on. This indicates that the engine oil tank contains over 20 percent but less than 80 percent of capacity.

Pressing the master press-to-test switch causes the OIL LOW light to come on verifying all of the system except the 80-percent sensing circuit. The 80-percent sensing circuit may be verified by pressing the oil quantity indicator/switch and the master press-to-test switch simultaneously, causing the OIL LOW light to come on.

NOTE

After securing the engine, oil seeps past the high-pressure oil pump into the accessory gearcase. To obtain an accurate indication, an oil quantity check should be made within 30 minutes after engine shutdown, or when the engine has run for 8 minutes or longer at 75 percent rpm or higher, and the scavage pump has returned the oil to the tank. False indications may be obtained if the oil quantity check is made during taxi or takeoff, since engine acceleration disrupts the oil level.

FUEL SYSTEM

The internal fuel supply is carried in two tanks containing a total of 807 US gallons. These tanks can be serviced by means of two gravity fuel tank fillers or a single-point pressure fueling receptacle.

The total usable fuel of an aircraft that is pressure-fueled and configured with two 300-gallon drop tanks and a 400-gallon centerline drop tank is 1793 gallons. Fuel is normally transferred from the drop tanks by tank pressurization and from the wing integral tank by an air-driven fuel transfer pump. Emergency wing fuel transfer may be accomplished by wing tank pressurization on all A-4F aircraft; and on all A-4E aircraft reworked per A-4 AFC 209. All fuel is delivered to the fuselage tank, from which an electrically driven fuel boost pump delivers the fuel under pressure to the engine-driven fuel pump. A manual fuel shutoff control lever is provided in the cockpit. (Figure 1-27 for fuel grades and specifications of recommended and emergency fuels, and figures FO-3 and FO-4 for a schematic presentation of the fuel system.)

Fuel Tanks

INTERNAL TANKS

Internal tanks comprise an integral wing tank and a self-sealing type fuselage tank mounted between the cockpit and the engine bay. The fuselage tank contains

the control valve for regulation of transfer fuel flow, the fuel boost pump which delivers fuel to the engine, and a fuel sump with flapper valves. The flapper valves assure a flow of fuel to the fuel pump regardless of attitude and during maneuvers involving negative g-loads and inverted flight for approximately 30 seconds.

Both fuel tanks are vented. The vent system exit is located aft of the right main landing gear strut and is designed to provide a small amount of ram air pressure in the fuel vent system to reduce the amount of collapse of the self-sealing type fuselage tank when it is partially full. Both tanks incorporate provisions for gravity filling, pressure fueling and defueling, and water and sediment drainage. (For information concerning total and usable fuel capacities of each tank, see figure 1-8.)

EXTERNAL TANKS

Provisions are made for carrying drop tanks singly or in combination. The inboard and centerline external stores racks will accommodate either 150-gallon or 300-gallon drop tanks. The centerline rack will also accommodate a 400-gallon drop tank. All drop tanks are vented, and contain provisions for gravity fueling, pressure fueling, and pressurization to effect fuel transfer to the integral wing tank at the option of the pilot. The drop tanks may be jettisoned in the same manner as other droppable external stores.

Fuel Transfer

WING TANK TRANSFER

The wing tank air turbine driven transfer pump utilizes engine compressor bleed air for power, and operates whenever the engine is running. Since the pump operates continuously, a fuel control float valve is placed in the fuselage tank to stop the transfer of fuel whenever the fuselage tank is full, in order to prevent transfer fuel from being pumped overboard through the fuel vent system. A fuel transfer failure caution light is provided on the left side of the instrument panel and comes on when wing tank fuel transfer pressure drops below 2 (+1/4, -1/8) psi. When engine rpm is above 70 percent, the light being on is an indication of possible fuel transfer pump failure or wing tank fuel depletion. Maneuvering flight may cause the pump to become temporarily unported, causing intermittent flashing of the fuel transfer caution light. Engine rpm settings below approximately 70 percent provide insufficient bleed air pressure to maintain the required fuel transfer pressure, thus causing the caution light to come on. In this situation, fuel may continue to transfer at a reduced rate. Increasing rpm above 70 percent will cause the light to go off, indicating normal fuel transfer has resumed.

CAUTION

- Effectivity: All A-4E aircraft reworked per A-4 AFC 209 but not reworked per A-4 AFC 469. Inadvertent fuel dumping may occur when the drop tanks switch is in the PRESS position. If this happens, immediately place drop tanks switch in OFF. Next, place fuel transfer bypass switch in FUEL TRANS BYPASS (A-4 AFC 317) and pressurize drop tanks. If aircraft has not been reworked per A-4 AFC 317, place drop tanks transfer switch in OFF and divert to nearest suitable landing field.

- Effectivity: All A-4F aircraft not reworked per A-4 AFC 469. Inadvertent fuel dumping may occur when drop tanks switch is in PRESS position. If this happens, immediately place drop tanks switch in OFF. Next, place air refueling fuselage-only switch in FUS ONLY and pressurize drop tanks.

NOTE

Effectivity: All A-4E aircraft reworked per AFC 331 and all A-4F aircraft. The bleed air lines running to the transfer pump allow sufficient bleed air to transfer fuel at idle. Sufficient fuel transfer may occur at idle to turn off the FUEL TRANS light.

DROP TANK TRANSFER

Fuel transfer from the drop tanks to the integral wing tank and fuselage tank is effected by means of drop tank pressurization. Placing the drop tank transfer switch on the engine control panel (figures FO-1 and FO-2) in PRESS opens a solenoid-operated air shutoff valve which directs engine compressor bleed air to the drop tanks. Once the tanks are pressurized, the flow of fuel from the drop tanks to the wing tank is controlled by the duel float pilot valve in the wing tank, which stops the transfer of fuel when the wing tank is full or allows it to continue when space is available. If the wing tank is full and the fuselage tank is not (as in the case of wing tank transfer pump failure), drop tank fuel will flow directly to the fuselage tank. Placing the drop tank transfer switch in OFF energizes the drop tank air

shutoff valve, thereby closing the valve and discontinuing transfer of fuel from the drop tanks. If electrical failure occurs, the drop tank air shutoff valve is automatically opened, providing immediate and automatic transfer of drop tank fuel as wing tank space permits. To prevent drop tank pressurizing air from being exhausted overboard through the drop tank vent, each drop tank is equipped with a combination float and diaphragm vent shutoff valve. This valve acts to close the drop tank vent when the tank is full or pressurizing air is introduced.

Fuel transfer from the drop tanks from sea level to 5000 feet altitude is 8000 PPH; and, from 25,000 to 35,000 feet altitude is 4000 PPH (90 percent power setting).

NOTE

- Unless the drop tanks fueling switch in the engine aft compartment is in OFF position, fuel transfer from the drop tanks will not be possible in the air except by extending the emergency generator.
- A noticeable thumping may be experienced during the latter stages of drop tank transfer.
- Venting of fuel through the wing cell vent mast may occur in the latter stages of drop tank transfer. Placing the drop tank switch to OFF will stop the venting. Drop tanks should be repressurized only when the wing cell is not completely full.

WARNING

Damaged integral wing tanks may include damage of drop tank fuel transfer lines, which are routed through wing tanks. An attempt to fuel drop tanks with broken transfer lines will result in loss of fuel and will also create a fire hazard condition.

EMERGENCY TRANSFER

Effectivity: All A-4F aircraft; all A-4E aircraft reworked per A-4 AFC 209.

Emergency transfer of fuel from the wing tanks to the fuselage tank is possible. A WING FUEL switch located on the engine control panel (figures FO-1 and FO-2) provides for the transfer of fuel by wing tank pressurization. Moving the switch to the EMER TRANS position closes the wing tank pressure and vent valves allowing engine compressor bleed air to pressurize the wing tank. Fuel is then transferred to the fuselage tank through the pressure fueling line. If normal transfer failure was caused by a failure of the transfer pump, emergency transfer fuel will also flow through the regular transfer line as well as the pressure fueling line to the fuselage tank.

CAUTION

- It is possible to pressurize the wing tank in excess of 8 psi and dump fuel out the dump mast when the wing fuel switch is in EMER TRANS position, if fuel covers the fuel vent outlet. This condition can exist during negative g flight or when aircraft is in nosedown attitude.
- Refer to part 4 of this section for limitations applicable to flight with the wing tank pressurized.
- The WING FUEL switch must be in OFF position during air refueling, hot refueling, or ground refueling with electrical power applied to the aircraft. This procedure will prevent dumping of fuel overboard through wing fuel dump valve.

When centerline drop tank is installed, the following sequence should be used to prevent transfer of wing fuel to centerline drop tank when the wing tank is pressurized. First, transfer all drop tank fuel that will fill the wing tank and then flow directly to fuselage tank. Then, while maintaining drop tank pressurization, initiate emergency transfer. Air pressure in center drop tank will prevent flow of fuel from wing down into center drop tank, where it would be unavailable for immediate emergency transfer.

NOTE

- Drop tank fuel transfer may not be possible with the emergency fuel transfer switch activated.
- The emergency wing tank fuel transfer system will not operate on the emergency generator.

FUEL CONSUMPTION EFFECTS ON AIRCRAFT CENTER OF GRAVITY

Drop tank fuel consumption has the least effect on center of gravity movement. The center of gravity

will move approximately 1-percent MAC (mean aerodynamic chord) forward as the drop tank fuel goes from full to empty. Aircraft normal fuel scheduling maintains the fuselage tank at a 1400- to 1500-pound level by transfer of drop tank fuel and then wing tank fuel. Wing tank fuel consumption causes the center of gravity to move forward until the wing tank is empty. The center of gravity will move forward approximately 6-percent MAC as wing tank fuel goes from full to empty. The aircraft will be at the most forward center of gravity for a given configuration when only the fuselage tank is full. Fuselage tank fuel consumption causes the center of gravity to move aft. The center of gravity will move aft approximately 7-percent MAC as the fuselage tank fuel goes from normal fuselage fuel level to empty.

Approximately the same center of gravity position will exist with normal fuselage tank fuel and 4000 pounds of remaining wing tank fuel as with only 600 pounds of remaining fuselage tank fuel.

FUEL TRANSFER RATES (Basis: Fuel lab tests using JP-5)

NORMAL FUEL TRANSFER

Air Turbine Pump Fuel Transfer from Wing to Fuselage Tank

ALT	MACH	Gallons-	Pounds/Hr
SL	V min	1260	8568
15,000	V min	1200	8160
25,000	V min	1200	8160
35,000	V min	1080	7344
SL	V max	2880+	19,584±
15,000	V max	2880	19,584
25,000	V max	2400	16,320
35,000	V max	1920	13,056

Drop Tank Stores to Internal Fuel Tanks

	Pounds/Hr
Wing drop tanks (two	9,500
Centerline drop tank	5,500
Two wing/centerline drop tank combination	14,000

NOTE

Drop tank fuel transfer rates apply from SL to 40,000 feet for all flights except idle descent.

Wing Tank/Air Refueling Store

	Gallons-	Pounds/Min
Wing tank to air refueling store	80 to 100	544 to 680
Air refueling store to wing tank	14 to 18	95 to 122.4
Air refueling store to receiver aircraft	180	1224

EMERGENCY FUEL TRANSFER

	Gallons-	Pounds/Min
Wing to fuselage tank	21	142.8

FUEL DUMP RATES

	Gallons-	Pounds/Min
Wing tank	100+	680+
Air refueling store	100	680

WING TANK FUEL DUMP AND PRESSURE RELIEF

Effectivity: All A-4F aircraft; all A-4E reworked per A-4 AFC 209.

CAUTION

When operating the valve pneumatically (dump function) after each valve closure, a minimum of 2 minutes shall be allowed for all fuel drainage from the diaphragm cavity prior to reactivating dump switch; otherwise, damage to the diaphragm may result.

A valve installed in the wing tank will prevent overpressurization of the tank and will allow wing tank fuel to be dumped overboard if desired. Placing the WING FUEL switch, located on the engine control

panel in the DUMP position will allow wing fuel to flow by gravity out the dump mast on the right main landing gear fairing at the rate of approximately 100 gallons per minute.

CAUTION

Dumping wing fuel above the freezing level may result in the dump valve freezing open. Fuel dump will then continue until the wing tank fuel is depleted or descent is made below the freezing level.

NOTE

- While dumping wing tank fuel, monitor the fuel quantity indicator closely to preclude inadvertent dumping of fuel below the desired level.
- The WING FUEL switch must be in OFF position during air refueling, hot refueling, or ground refueling with electrical power applied to the aircraft. This will prevent dumping of fuel overboard through wing fuel dump valve.

SCUPPER DRAIN (GANG DRAIN)

The mast located aft of the aft fuselage lower access door drains various aircraft and engine areas. Any fluid seen venting from this mast other than on shutdown may indicate a serious malfunction or leak and is cause for immediate landing and investigation. This mast should not be mistaken for the wing tank dump mast located aft of the right main gear.

FUEL TRANSFER BYPASS SWITCH

Effectivity: All A-4E aircraft reworked per A-4 AFC 317.

A fuel transfer bypass switch has been installed on the rain removal panel located on the right console. When the switch is placed in the FUEL TRANS BYPASS position during air refueling, fuel flows into the fuselage fuel tank only. The switch is normally used when the receiver aircraft has wing damage to prevent fuel from entering a damaged wing tank thus averting a fuel loss/fire hazard condition.

Air refueling of the droptanks and fuselage fuel tank (bypassing the wing tanks) is possible by placing the DROP TANKS switch in the FLIGHT REFUEL position, in addition to placing the fuel transfer bypass switch in the FUEL TRANS BYPASS position.

If wing tank damage is causing loss of fuel, any fuel remaining in the drop tanks may be transferred directly to the fuselage tank by activating the FUEL TRANSFER BYPASS switch and pressurizing the drop tanks. Indication of fuel transfer may take as long as 10 minutes if activated with 400 pounds of fuel or less remaining in each drop tank.

CAUTION

If drop tank transfer lines, which are routed through wing tanks, are damaged, transfer of drop tank fuel or attempted air refueling of drop tanks could constitute a fire hazard.

AIR REFUELING FUSELAGE ONLY SWITCH

Effectivity: All A-4F aircraft.

The air refueling fuselage-only switch is installed on the engine control panel located in the left console. When the switch is placed in the FUS ONLY position during air refueling, fuel flows into the fuselage fuel tank only. The switch is normally used when the receiver aircraft has wing damage to prevent fuel from entering a damaged wing tank thus averting a fuel loss/fire hazard condition. Air refueling of the drop tanks and fuselage fuel tank (bypassing the wing tanks) is possible by placing the DROP TANK switch in the FLIGHT REFUEL position, in addition to placing the air refueling fuselage-only switch in the FUS ONLY position. If wing tank damage is causing loss of fuel, any fuel remaining in the drop tanks may be transferred directly to the fuselage tank by activating the FUS ONLY switch and pressurizing the drop tanks. Indication of fuel transfer may take as long as 10 minutes if activated with 400 pounds of fuel or less remaining in each drop tank.

CAUTION

If drop tank transfer lines, which are routed through wing tanks, are damaged, transfer of drop tank fuel or attempted air refueling of drop tanks could constitute a fire hazard.

FUEL BOOST PUMP

An electrically driven fuel boost pump is submerged in the fuselage tank sump. The fuselage tank sump incorporates flapper valves that act to keep the boost pump fuel inlet supplied with fuel in all aircraft attitudes, including diving flight and negative g or

FUEL QUANTITY DATA

GALLONS -- POUNDS

TANKS	USABLE FUEL			UNUSABLE FUEL LEVEL FLIGHT	EXPANSION SPACE	TOTAL VOLUME
	GAL-LONS	POUNDS				
		JP-4	JP-5			
INTEGRAL WING PRESSURE FUELING	560	3640	3808	6	9	585
INTEGRAL WING GRAVITY FUELING	570	3705	3876			
FUSELAGE PRESSURE FUELING	230	1495	1564	0	0	240
FUSELAGE GRAVITY FUELING	237	1541	1612			
LH WING (INBOARD WING RACK)						
150 GALLON DROP	147	956	1000	2	1	150
300 GALLON DROP	295	1918	2006	4	1	300
CENTERLINE						
150 GALLON DROP	147	956	1000	2	1	150
300 GALLON DROP	295	1918	2006	4	1	300
300 GALLON AIR REFUELING STORE	295	1918	2006	4	1	300
400 GALLON DROP	396	2574	2692	3	2	401
RH WING (INBOARD WING RACK)						
150 GALLON DROP	147	956	1000	2	1	150
300 GALLON DROP	295	1918	2006	4	1	300

USABLE FUEL TOTALS

TANKS	PRES-SURE FUELING	* POUNDS JP-4	JP-5	GRAVITY FUELING	* POUNDS JP-4	JP-5
FUSELAGE, WING	790	5135	5372	807	5245	5487
FUSELAGE, WING, (150) CENTER DROP	937	6090	6371	954	6201	6487
FUSELAGE, WING, (300) CENTER DROP	1085	7052	7378	1102	7163	7493
FUSELAGE, WING, (300) AIR REFUELING STORE	1085	7052	7378	1102	7163	7493
FUSELAGE, WING, (400) CENTER DROP	1186	7709	8064	1203	7819	8179
FUSELAGE, WING, TWO (150) WING RACK DROP	1084	7046	7371	1101	7156	7486
FUSELAGE, WING, (150) CENTER, TWO (150) WING RACK DROP	1231	8001	8370	1248	8112	8486
FUSELAGE, WING, (300) CENTER, TWO (150) WING RACK DROP	1379	8963	9377	1396	9074	9492
FUSELAGE, WING, (400) CENTER, TWO (150) WING RACK DROP	1480	9620	10,063	1497	9730	10,178
FUSELAGE, WING, TWO (300) WING RACK DROP	1380	8970	9384	1397	9080	9499
FUSELAGE, WING,(150) CENTER, TWO (300) WING RACK DROP	1527	9926	10,383	1544	10,036	10,499
FUSELAGE, WING,(300) CENTER, TWO (300) WING RACK DROP	1675	10,887	11,390	1692	10,998	11,505
FUSELAGE, WING, (400) CENTER, TWO (300) WING RACK DROP	1776	11,544	12,076	1793	11,654	12,191

NOTE:

* Calculated for standard day conditions using 6.5 LB/GAL for JP-4
6.8 LB/GAL for JP-5

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Figure 1-8. Fuel Quantity Data

inverted flight not to exceed 30 seconds duration. Operation of the fuel boost pump is automatic whenever the aircraft electrical system is energized by the main generator, by external power, or by external power through the ground test switch (Effectivity: A-4E aircraft reworked per A-4 AFC 207A, and all A-4F aircraft). In the event of main generator failure, the fuel boost pump will be inoperative and will remain so even though the emergency generator is deployed. (Refer to section V, Fuel Boost Pump Failure.)

FUEL BOOST PRESSURE INDICATOR. Loss of fuel boost pressure is indicated by a FUEL BOOST warning light located on the caution panel, left-hand side of the instrument panel (figures FO-1 and FO-2). The warning light will come on whenever fuel boost pressure falls below 4 psi and will go out at 6 psi.

MANUAL FUEL SHUTOFF CONTROL LEVER

The fuel system incorporates a manually operated fuel shutoff control lever (figures FO-1 and FO-2) located outboard of the left-hand console. This lever has two positions, NORMAL and EMER OFF. The EMER OFF position of the control stops all fuel flow from the aircraft fuel system to the engine fuel control system. A spring-loaded lift-type guard is provided to prevent inadvertent movement of the lever to EMER OFF. To ensure complete fuel shutoff, the control lever must be moved fully aft into the EMER OFF detent.

Fuel Quantity Indicating System

The fuel quantity indicating system is comprised of capacitance-type fuel quantity probes, a fuel quantity indicator, a low-level switch, fuel quantity test switch, and associated wiring. The wing tank contains six fuel quantity probes. Each external fuel tank and the fuselage tank contains one fuel quantity probe. The probes are wired into the fuel quantity indicator in such a manner as to indicate the total quantity of fuel remaining in the internal tanks when the fuselage tank contains more than 170 gallons (approximately 1100 pounds). External fuel tanks quantity is checked by placing the internal-external fuel switch in EXT. Air refueling stores do not have fuel gaging provisions unless reworked by Accessory Change AYC 86, Installation of MODEL D-704 IN-FLIGHT REFUELING STORE; Fuel Quantity Indicator. Air refueling stores with AYC 86 incorporated will provide fuel quantity when the external fuel quantity switch is actuated, the same as the drop tank.

The effect of aircraft attitude on the relationship between indicated and actual total fuel quantity is shown on figure 1-9. When the fuselage tank indicated fuel quantity is at or below 1000 pounds, and the aircraft attitude is between 4 degrees noseup and 4 degrees nosedown, indicated quantity can be considered to be actual quantity. Indicated airspeed for most accurate fuel reading is 250 KIAS.

LOW FUEL STATE WARNING INDICATOR

The fuselage tank contains a low-level switch (thermistor bead) located approximately one-third of the distance down the length of the fuel quantity probe at about the 170-gallon level (approximately 1100 pounds). If the fuel supply in the fuselage tank falls below this level due to malfunction of the wing tank transfer system, or failure or mismanagement of the drop tank transfer system, the low-level switch will cause the reading of any remaining wing-tank transfer fuel to be dropped out, indicating to the pilot that approximately 170 gallons of usable fuselage fuel remains.

FUEL QUANTITY INDICATOR

The fuel quantity indicator (figures FO-1 and FO-2), located on the instrument panel, indicates the total fuel available in pounds multiplied by 1000. The range of indication is from 0 to 6400 pounds.

NOTE

- With failure of the dc converter circuit, no dc power will be available to the fuel quantity control unit. As a result, the fuel quantity indicator will indicate only fuel available in the fuselage fuel cell (fuel available in the wing tank will not be included). This fuel indication will be approximately 1400 pounds with the engine operating. As total usable fuel becomes less than 1400 pounds, the correct fuel quantity will be indicated.
- Maneuvering or accelerated flight causes erroneous fuel quantity indications.

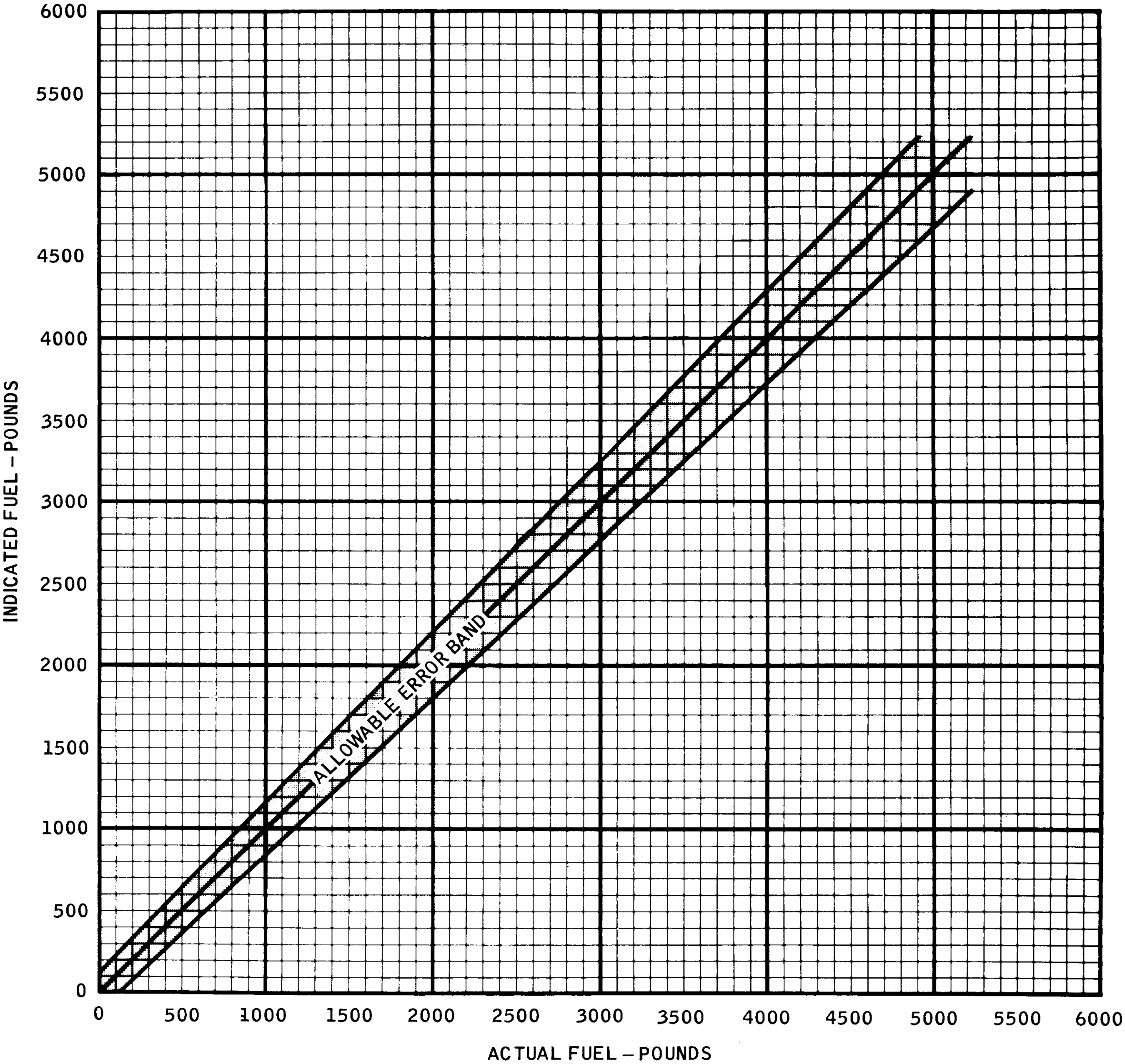
The fuel quantity indicator gage, may be tested by the press-to-test switch (figures FO-1 and FO-2) on the instrument panel. When the test switch is depressed, the fuel quantity indicator pointer will rotate in a counterclockwise direction. When the test switch is released, the pointer will return to the original indication if all units of the fuel quantity measuring circuit are functioning properly.

INTERNAL-EXTERNAL FUEL SWITCH

A toggle switch (A-4E) (pushbutton switch, A-4F) labeled INT-EXT, is located on the instrument panel for checking external fuel load. The switch is spring loaded to the INT position. External fuel quantity will be indicated when the switch is held (A-4E) to the EXT position (pushed to the EXT position, A-4F) until the indicator needle stabilizes.

FUEL/ATTITUDE CALIBRATION

DATA AS OF: 1 JANUARY 1967
DATA BASIS: CONTRACTOR'S CALIBRATION



REMARKS:

(1) ALLOWABLE ERROR BAND PER MIL-G-7940.

(2) JP-5 FUEL.

EXAMPLE:

ASSUME INDICATED FUEL IS 4000 POUNDS.

(1) READ ACROSS TO ALLOWABLE ERROR BAND.

(2) ACTUAL FUEL IS EQUAL TO 3700 POUNDS (MINIMUM) TO 4300 POUNDS (MAXIMUM).

HH1-16

Figure 1-9. Fuel Quantity Calibration Chart

Single-Point Fueling and Defueling System

The pressure fueling system is designed to permit fueling at a rate of 200 gallons per minute through a single-point pressure fueling receptacle, located at the trailing edge of the wing just inside the aft engine compartment access door. The system may be defueled through the same receptacle at a rate of approximately 100 gallons a minute.

PRESSURE FUELING SWITCH PANEL

The pressure fueling switch panel is located on the left side of the aft engine access compartment just inside the access door. This panel has two switches: the check switch, and the drop tank fueling switch. The check switch has three positions, PRIMARY OFF, FUELING ON, and SECONDARY OFF and is used to test the operation of the dual float shutoff valves. The drop tank fueling switch has two positions, ON and OFF. The ON position of the drop tank fueling switch energizes the drop tanks solenoid pilot valves, permitting pressure fueling of the drop tanks.

PRESSURE FUELING

When the wing and fuselage tanks are being fueled, fuel pressure opens the fueling shutoff valve in each tank, allowing fuel to enter the tank and also to flow through the sensing lines to the dual float pilot valve. When the tank becomes full, the floats close the pilot valve, causing pressure to increase behind the diaphragm of the shutoff valve and close it. Each shutoff valve consists of a primary float, which is the pilot for the shutoff valve; and a secondary float, which is a standby for the shutoff valve. Placing the check switch in either the PRIMARY OFF or SECONDARY OFF position causes solenoids to raise the respective float valve to simulate the normal shutoff valve action at the maximum fuel capacity level. This check can be made only after the pressure fueling operation has begun.

CAUTION

When external electrical power is not available during pressure fueling of the aircraft, the functional tests of pressure fueling shutoff components cannot be performed. Therefore, wing and fuselage tank gravity filler caps shall be removed during fueling to prevent possible damage to internal fuel tanks structure.

To fuel the drop tanks by means of the pressure fueling system, it is necessary to plug in external electrical power. Placing the drop tank fueling switch on the pressure fueling switch panel in ON energizes the normally closed solenoid pilot valve, permitting fuel pressure to open the drop tanks shutoff valves and, subsequently, to flow to the drop tanks. Under these conditions, fuel also flows through the sensing lines to the drop tanks solenoid pilot valves. As each drop tank becomes full, a float switch in the tank rises, breaking the electrical circuit to the energized solenoid pilot valve, causing the pilot valve to close and pressure to build up behind the diaphragm of the shutoff valve, which then also closes, disconnecting the pressure fueling to that tank.

NOTE

Unless the drop tank fueling switch in the aft compartment is in the OFF position after fueling the drop tanks and prior to takeoff, fuel transfer from the drop tanks will not be possible in the air. However, drop tank fuel transfer may be accomplished by extending the emergency generator.

When the air refueling store is installed instead of the center drop tank, it is fueled through the pressure fueling receptacle on the store.

PRESSURE DEFUELING

To defuel the integral wing tank requires no procedure other than connecting the defueling hose to the pressure fueling receptacle. To defuel the fuselage tank it is necessary to operate the manual override check valve between the wing and fuselage tanks. When the defueling operation is begun, negative pressure in the pressure fueling shutoff valves will open the valves and allow the fuel to be removed. When either the fuselage or wing tank becomes empty, the defueling low-level float valve opens, increasing the pressure behind the diaphragm of the shutoff valve, causing the valve to close. This prevents air from entering the defueling line and breaking the siphon when one tank empties ahead of the other.

To defuel the drop tanks through the pressure fueling system, it is necessary to connect a source of air pressure to the capped tee in the drop tanks pressurizing system, and first transfer the drop tanks fuel into the integral wing tank.

ELECTRICAL SYSTEM

Electrical power is normally supplied by a 10-kva, engine-driven generator, which furnishes 115/200-vac, 3-phase, 400-cycle, constant frequency ac power, and through a dc converter. No dc generator or battery is provided. An additional transformer modifies generator power to 26-vac power for the operation of certain equipment. Eight buses serve to distribute power to the various electrical units. An airstream-operated emergency generator provides

electrical power to essential equipment in the event of main generator or engine failure. External power can be used to energize the system through an external power receptacle located in the lower forward plating of the left-hand wing root. Operation of the electrical system is completely automatic, with the exception of the emergency generator, which must be activated by the pilot upon failure of the main generator. (Refer to section V for emergency operation of the electrical system, and figure FO-5 for schematic presentation of normal and emergency electrical power distribution.)

Main Generator

The generator is driven at a constant speed of 8000 rpm over the entire operating range of the engine from idle to maximum power by the constant speed drive unit. A test unit may be plugged into the receptacle on the fuse panel in the nosewheel well to ascertain that the generator is operating within prescribed limits. An underfrequency protector (all A-4F, A-4E reworked per A-4 AFC 338) is connected between the output of the main generator and the voltage regulator to prevent the supply of low frequency power to electronic equipment during engine shutdown or constant speed drive malfunction.

External Power Switch

When the external power switch is in the EXTERNAL position, the aft monitored bus is disconnected from the main generator and is connected to the external power receptacle, so that power from an external source may be applied to the system. The external power receptacle door cannot be closed when the switch is in the EXTERNAL position.

Emergency Generator

The emergency generator, rated at 1.7 kva, is carried in a compartment in the lower right-hand side of the forward fuselage. When the generator is released into the airstream, a variable pitch propeller governs the speed of the generator at approximately 12,000 rpm to provide 400-cycle power to the primary and monitored primary buses.

EMERGENCY GENERATOR BYPASS SWITCH

An emergency generator bypass switch labeled NORMAL-BYPASS is located in the right-hand console (figures FO-1 and FO-2). If the emergency generator is extended, placing this switch in BYPASS allows the pilot to return to main generator operation providing main generator power has been regained.

EMERGENCY GENERATOR RELEASE HANDLE

The emergency generator release T-handle (figures 1-5 and 1-6) on the extreme right side of the cockpit, above the right console, provides control of the emergency electrical system in the event of main generator failure. When the handle is pulled, the emergency generator drops into the airstream, the main generator becomes disconnected from the electrical system, and the primary and monitored primary bus are connected to the emergency generator. The emergency generator bypass switch must be in the NORMAL position.

NOTE

Electrical power will be provided by the emergency generator only if the emergency generator bypass switch is in NORMAL.

Once the emergency generator is extended, there is no way to retract it to the normal stowed position while in flight.

AC Power Distribution

NORMAL AC POWER

Power from the main generator is sampled by a voltage regulator. The voltage regulator maintains a constant voltage output from the main generator by varying the current in the generator exciter field. The voltage-regulated power moves through the INTERNAL position of the external power switch.

EMERGENCY AC POWER

Extending the emergency generator into the airstream breaks the main generator exciter field circuit, rendering the main generator inoperative, and transfers the primary bus and monitored primary bus from the aft monitored bus to the emergency generator (figure FO-5). If either the horizontal stabilizer manual override lever or the AMAC SYS EMER PWR switch is actuated while operating on emergency generator, the monitored primary bus will be lost as all emergency generator power is diverted to the primary bus. Upon releasing the manual override, or returning the AMAC SYS switch to the NORM position, power is again directed to the monitored primary bus.

DC Power Distribution

The primary bus supplies 115/200-vac, 3-phase, 400-cycle ac power to a single dc converter, which converts the ac power to 28-vdc power, and powers

both the 28-vdc primary bus and the monitored dc bus.

ARMAMENT BUS

The armament bus receives dc power provided that the master armament switch is ON and the landing gear handle is UP. An armament safety switch, actuated by the DOWN position of the landing gear handle, deenergizes the armament bus as a safety feature to prevent inadvertent firing of the guns or release of stores when the aircraft is on the ground or in the landing pattern with the wheels down.

ARMAMENT SAFETY DISABLE SWITCH

The armament safety disable switch is located on the outboard side of the right-hand wheel well for ground testing of the armament circuit. When the master armament switch in ON and the armament safety disable switch is momentarily depressed, an armament safety disabling relay is closed, allowing power to energize the armament bus. The relay is held closed until the master armament switch is turned off, or electrical power is disconnected from the aircraft. When this occurs, the armament safety feature is automatically reinstated.

Fuse Panels

All electrical circuits, with the exception of the all attitude indicating system, are protected by fuses in lieu of circuit breakers in order to save weight and provide better wire protection. The fuses are located on three panels; two in the nosewheel well and the other in the forward engine compartment.

FIRE DETECTION SYSTEM

The fire detection system will indicate the existence of fire in the area surrounding the engine, tailpipe, and accessories section. If fire occurs in these locations, a push-to-test type FIRE warning light (figure 1-5 and 1-6) on the glareshield will glow. The fire detection system may be checked by depressing the master press-to-test button. When the button is depressed, the FIRE warning light will glow, indicating a properly functioning circuit. This system discriminates against short circuits and prevents illumination of the fire warning light by either the fire detection control unit or press-to-test button when a short exists.

HYDRAULIC SYSTEMS

The hydraulic systems consist of the utility hydraulic system and the flight control hydraulic system utilizing two self-pressurizing fluid reservoirs and two identical engine-driven variable displacement pumps. Both reservoirs are located in the upper right-hand side of the fuselage over the center of the wing, with the flight control system reservoir aft of the utility system reservoir. Capacity of the utility system reservoir is 1.25 gallons of hydraulic fluid; that of the flight control system, 0.30 gallon. Each system operates normally under a pressure of 3000 psi, and relief valves in each system open at 3650 psi to prevent damage to the lines and equipment, should the pump displacement compensator fail. Tandem power cylinders are used in the aileron, elevator, and rudder power controls; one-half of each cylinder being operated by flight control system pressure, and the other half by utility system pressure. This arrangement allows the ailerons, elevator and rudder to be power-operated at reduced hinge movements by either system in the event of failure of the other.

The flight control hydraulic system powers only its half of the aileron, elevator, and rudder tandem actuating cylinders. The utility hydraulic system, in addition to powering one-half of the aileron, elevator, and rudder tandem actuating cylinders, also operates the landing gear, wing flaps, speedbrakes, arresting hook, autopilot servos, spoilers, and nosewheel steering. Hydraulic pressure warning lights are provided in the cockpit for each of the two systems. Pressure gages for both systems are installed in the right-hand wheel well. There is no auxiliary pump and no hydraulic pressure is available for ground operation unless the engine is running. Whenever the engine is running, normal pressure is supplied to both the flight control and the utility systems.

Both of the engine-driven hydraulic pumps are of the constant pressure, variable displacement type. The flow of fluid through each system will vary in rate (gallons per minute) with the operating speed of the associated pump. As rate of fluid flow determines the speed at which the various hydraulically operated units responded to actuation of their individual controls, variation in rate of flow with power changes during normal operation might ordinarily produce objectionable characteristics in operation of the hydraulic systems. Therefore, flow restrictors have been installed in the subsystems to regulate the maximum rate of flow. The flow restrictors prevent the wing flaps, speedbrakes, and arresting hook from operating too fast when fluid flow is at its peak, yet do not affect the time of operation when flow is reduced at low engine speeds. As long as the engine is turning at IDLE rpm or greater, the hydraulically operated units will operate against the usual loads. However, at engine windmilling speeds, fluid flow is greatly reduced, and the time required for hydraulically operated units to respond fully is increased. (See figures FO-6 and FO-7 for a schematic diagram of the hydraulic systems.)

Either the utility hydraulic system warning light or the flight control hydraulic system warning light (ladder lights) will indicate loss of pressure to one or the other of the hydraulic systems. No stiffening of the control stick, except near full surface deflection at high speeds, will be encountered except with complete failure of both the flight control and the utility hydraulic systems.

When operating on the utility hydraulic system alone, actuations of various units normally operated by utility pressure will cause a temporary decrease in the effectiveness of the flight controls.

No means are available for the pilot to correct hydraulic system failure. For action to be taken in the event of failure, refer to section V.

FLIGHT CONTROL SYSTEM

The primary flight controls systems are tandem full power hydraulic systems with artificial feel supplied by bungee springs in parallel with the controls. Motion of the stick or rudder pedals is transmitted through linkage and cable systems to the control valve. The valve ports fluid to the power cylinder, which in turn actuates the control surfaces. Each of the three systems, the aileron, elevator, and rudder, is a tandem hydraulic system.

Aileron and rudder trim is obtained by repositioning the neutral force point of a load-feel bungee. Longitudinal trim is obtained by positioning the horizontal stabilizer.

In the event of total hydraulic power failure, the aileron and elevator power cylinders may be disconnected and control is maintained manually. The rudder system cannot be disconnected. With a loss of hydraulic power, the rudder control valve ports the two cylinder ports together so that the rudder can be controlled manually through the manual by-pass linkage.

Hydraulic servos in parallel with the pilot operated controls provide the aileron and elevator control forces required for automatic flight control. A load feel bungee is placed in series with the elevator servo to limit its force output for structural protection.

The rudder control system is provided with a dual input electromechanical control valve so that AFCS commands may be added to pilot commands. With AFCS or STAB AUG engaged the valve operates electrically. With AFCS and STAB AUG disengaged the valve operates mechanically.

The aileron and rudder control surfaces have rotary viscous dampers to reduce surface buzz.

CAUTION

Do not attempt maneuvers requiring high control forces (such as high speed pullouts) when it is known beforehand that one or both of the systems are inoperative.

Aileron Control

Both ailerons are aerodynamically and statically balanced. Lateral movement of the control stick positions the aileron control valve so that hydraulic fluid at 3000 psi is ported to the aileron power cylinder. The aileron power cylinder operates push-pull tubes to the ailerons, causing the latter to be deflected in the desired direction. Because the aileron power control is irreversible, there is no feedback to the pilot of air loads against the ailerons; therefore, artificial "feel" is provided by a spring bungee. The action of the spring bungee opposes the movement of the control stick.

Aileron Trim System

An electrically powered aileron trim actuator is controlled by movement of the trim switch (figure 1-22) on the stick grip to LWD (lift wing down) or RWD (right wing down). The trim actuator moves the stick, power system linkages, and consequently, the ailerons to the desired trim position by changing the neutral position of the aileron load feel and centering bungee. At the same time, it positions a followup tab on the left aileron so that the aircraft will remain approximately in trim whenever the power system is disconnected. The position of the followup tab has negligible effect on lateral trim during flight utilizing either or both hydraulic power control systems.

If the hydraulic power system has been disconnected, the pilot continues to trim the ailerons in the same manner, except that now the followup tab is positioning the surfaces, and the aerodynamic forces on the ailerons will be felt by the pilot through the manual control system. The in-trim angular position of the aileron tab will vary between individual aircraft due to manufacturing tolerances, and is established by company test pilots prior to fleet delivery of each aircraft. Theoretically this setting should not change during the service life of the aircraft unless some change is made to its aerodynamic configuration. For safety of flight, it is mandatory that the in-trim position be reestablished after an aileron or wing change since this determines the range of action of the tab. Failure to do so may result in uncontrollable rolling tendencies when the power system is disconnected. (Refer to Hydraulic Power Disconnect.)

The stick trim actuator is inoperative when the emergency generator is in use. No indicator is provided to show the trim position of the ailerons and tab, but the control stick is displaced from center to a new neutral position as the trim tab and ailerons are moved from their faired positions by the trim actuator.

Elevator Control

Fore and aft movement of the control stick moves a pushrod attached to the elevator control valve, which ports hydraulic pressure to the elevator power control cylinder. The cylinder then, through mechanical linkage, deflects the elevator surface as desired. The elevator power control is aerodynamically irreversible and pilot's feel is induced by a spring bungee in the elevator control system. The forward and aft bob-weights also provide additional feel during vertical and longitudinal accelerations to prevent the pilot from overstressing the empennage structure. The elevators are not equipped with trim tabs, as longitudinal trim is provided by a movable horizontal stabilizer. A bungee is installed in the elevator control system to provide longitudinal load feel. The bungee is linked to the horizontal stabilizer so that the elevator deflects upward (stick moves aft) while trimming noseup and deflect downward while trimming nosedown. The elevator moves approximately 8 degrees as the stabilizer travels from full-throw up to full-throw down. When elevator hydraulic power is lost, the elevator-stabilizer linkage is ineffective. The elevators are interconnected with the operation of the speedbrakes to assist the pilot in overcoming trim changes resulting from speedbrake operation. A system of cables and springs attached to the left speedbrake actuates the control cables between the stick and the elevator control valve. When speedbrakes are opened, this system pulls the nosedown elevator cable, moving the stick forward and actuating the elevator to reduce a noseup pitch. When the speedbrakes are closed, the stick moves aft to its original trimmed position, thus reducing nosedown pitch.

Horizontal Stabilizer Trim System

The entire surface of the horizontal stabilizer is moved by an electrically operated actuator to provide longitudinal trim. The actuator is controlled by forward and aft movement of the trim switch (figure 1-22) to NOSE DOWN or NOSE UP. The switch is spring loaded to the center or OFF position, and must be moved to the full extent of its travel in either direction to operate the horizontal stabilizer. Stabilizer travel is from 12 1/4±1/4 degrees noseup to 1 degree nosedown. The position of the horizontal stabilizer is shown on the trim position indicator.

MANUAL OVERRIDE LEVER

A horizontal stabilizer manual override lever (figures FO-1 and FO-2), located on the left console outboard of the throttle, will operate the horizontal stabilizer in the event the trim switch malfunctions. Forward or aft movement of the manual override lever causes a nosedown or noseup trim actuation, respectively, and overrides any opposing commands of the stick trim switch. When the emergency generator is being utilized, the manual override lever is the only means of actuating the horizontal stabilizer.

CAUTION

Do not run the actuator against the stops during the preflight check. Use of the horizontal stabilizer manual override lever does not cut out the actuator motor when the horizontal stabilizer reaches full travel. Continued operation of the manual override lever in one direction when the stabilizer is at the limit of travel will burn out the actuator motor and will cause complete loss of stabilizer control.

HORIZONTAL TRIM DISCONNECT SWITCH

A-4 aircraft reworked per COMNAVAIRPAC Aircraft Bulletin 11-63 are provided a trim disconnect switch, located on the port bulkhead/glareshield, which will interrupt all electrical power to the horizontal stabilizer trim motor.

The horizontal trim disconnect switch may be utilized during critical phases of flight, such as field takeoffs and catapult launches, precluding horizontal stabilizer runaway trim. (Refer to section V.)

RUDDER CONTROL

The aircraft is equipped with a rudder system operating at a reduced hydraulic pressure of 1150 psi. The rudder power control is operated by the flight control hydraulic system and the utility hydraulic system at the same reduced pressure. Movement of the rudder pedals mechanically positions the rudder electromechanical dual input servo valve. The valve ports hydraulic pressure to the rudder actuating cylinder as required. Since there is no feedback of air loads on the control surface of a hydraulic power system, a spring bungee is installed in the fin to center and restrain the control valve and rudder pedals, and to provide artificial feel. The rudder pedals are independently adjusted fore and aft by a lever located on the inboard side of each pedal.

Rudder Trim System

Directional trimming is accomplished by displacing the entire rudder surface as a result of repositioning the center or neutral point of the spring bungee through the action of an electrical motor controlled by the rudder trim switch (figures FO-1 and FO-2) on the left-hand console. Positions of the trim switch are NOSE LEFT and NOSE RIGHT. Rudder trim position is shown on the trim position indicator. Trim is not available during emergency generator operation.

NOTE

Loss of rudder hydraulic power results in loss of rudder trim.

Hydraulic Power Disconnect

A manual flight control T-handle (figures FO-1 and FO-2) on the lower right side of the instrument panel may be used to disconnect the elevator and aileron power cylinders from the flight controls in the event of complete hydraulic systems failure. After disconnect, stick forces are high, particularly for lateral deflections. At airspeeds in excess of 300 KIAS, stick forces become extremely high.

NOTE

- The rudder has no hydraulic disconnect.
- As long as (normal) electrical power is available, the aircraft can be trimmed laterally. Therefore, in the event of an actual hydraulic system failure, when the T-handle is pulled, if the aircraft starts to roll, it should be trimmed immediately.

NEW

CAUTION

Hold T-handle and allow it to return to stowed position to prevent handle from striking an instrument.

Before performing a hydraulic power disconnect under controlled conditions, the emergency generator should be extended and a functional check should be made of the emergency trim override. If the emergency trim override functions properly on emergency generator, switch to BYPASS and continue with the disconnect.

Trim Position Indicators

The positions of the rudder trim and the horizontal stabilizer are shown on the trim position indicators (figures FO-1 and FO-2) at the forward end of the right console. The rudder trim position indicator is graduated in 1-degree units to the L (left) and R (right) of 0. Total travel of the rudder trim position indicator represents 7 degrees of rudder travel left and right of center. All even degree marks are numbered from 0 through 6.

The scale for horizontal stabilizer position is graduated in 1-degree units from DN (down) through UP. All even numbered degree marks are identified numerically. Maximum indicators of the stabilizer trim position indicator are 3 degrees aircraft-nosedown and 13 degrees aircraft-noseup.

LANDING GEAR SYSTEM

The tricycle landing gear is retracted and extended by utility hydraulic system pressure during normal operation. The main gear retracts up and forward and the wheels rotate to fit flush into the wheel wells in the wings. The nose gear also retracts up and forward. The nose strut telescopes to allow the nosewheel to fit into the nosewheel well. When retracted, the landing gear is held up by utility hydraulic pressure and in the case of hydraulic system failure, the gear rests on the landing gear doors which are held closed by mechanical latches. For emergency extension of the landing gear, the door latches are manually released by the pilot.

Landing Gear Handle

The landing gear handle (figures 1-5 and 1-6) forward of the left cockpit rail controls the normal operation of the landing gear system. The landing gear handle has two positions, UP and DOWN, and is mechanically linked to the landing gear control valve. A mechanical guard attached to the handle locks the handle in the UP or DOWN position. Depressing the guard permits movement of the handle to the desired position.

A warning light in the wheel-shaped handle of the control comes on when the handle is moved to either of its two positions. The light remains on until the wheels are locked in either the up or down position. The position of the wheels is shown on the wheels and flaps position indicator on the left console. A flasher-type wheels warning light (figures 1-5 and 1-6) is installed beneath the upper left side of the glareshield adjacent to the LABS light. With the wing flap handle at any position other than the UP detent and the landing gear up or unsafe, retarding the throttle below approximately 92 percent rpm causes the WHEELS warning light to flash, informing the pilot of a possible unsafe condition.

To prevent movement of the landing gear handle to UP when the aircraft is on the ground, the landing gear handle is latched in the DOWN position. In normal operation, the retraction release switch

located on the left main landing gear strut, is actuated when the aircraft becomes airborne and the landing gear struts extend, energizing the safety solenoid. The solenoid then unlatches the handle. On emergency generator power, the retraction release safety solenoid is deenergized. If it should become necessary to retract the landing gear while on the ground, the serrated end of the latch on the landing gear control panel must be moved aft to unlatch the landing gear handle.

NOTE

If the landing gear handle cannot be raised and angle-of-attack (AOA) indexer does not come on immediately after takeoff, a possible retraction safety-solenoid malfunction is indicated. (Refer to section V, Retraction Safety-Solenoid Inoperative.)

Emergency Landing Gear System

CAUTION

If the landing gear handle is raised after the emergency landing gear release T-handle is pulled, the bulkhead brackets and the landing gear handle ratchet may be damaged.

In the event of utility hydraulic system failure, the landing gear may be lowered manually by means of the emergency landing gear release T-handle (figures 1-5 and 1-6) on the extreme left side of the cockpit, above the left console. When the landing gear control is moved to DOWN and the emergency landing gear release handle is pulled, the landing gear doors are unlatched, allowing the landing gear to drop into the airstream. The landing gear extends and locks by a combination of gravity and ram air force.

WING FLAPS

Split flaps are installed on the trailing edges of the wings. Hydraulically actuated by a single cylinder, the wing flaps are mechanically controlled by the flap handle (figures FO-1 and FO-2) on the left console, outboard of the throttle. The wing flaps may be extended 50 degrees by moving the flap handle to DOWN, or may be stopped at any intermediate position by placing the flap handle at STOP. When UP is selected, the flaps will retract fully. The position of the flaps is shown on the flaps position indicator. A relief valve in the wing flap system allows the flaps to blow back to prevent structural damage when airloads cause the hydraulic pressure within the actuating cylinder to exceed the pressure at which the relief valve opens (3650 psi). This automatic retraction will begin at approximately 230 KIAS.

NOTE

The flaps will not return automatically to the extended position if the flap handle is in the STOP position; therefore, it will be necessary to reposition the flaps after reducing airspeed below the blowback limit.

Wheels and Flaps Position Indicators

The position of the landing gear and wing flaps is presented on the wheels and flaps position indicators (figures FO-1 and FO-2) located on the left console. When the wheels are down and locked, the image of a wheel appears in a small window provided for each wheel on the instrument. When the landing gear is up and locked, the word UP appears in each window. During the time the landing gear is in transient, or the wheels are not locked in position, diagonally striped signals are shown in the windows. The position of the wing flaps is shown in units with respect to the wing. Each unit corresponds to one-quarter of the total amount of extension possible. Labeled positions are UP, 1/2, and DOWN.

NOSEWHEEL STEERING

Effectivity: All A-4F aircraft

The nosewheel steering system is operational only when the aircraft is on the ground. Steering may be engaged by actuation of the stick control button, provided hydraulic gear down pressure is available, and the NORMAL-EMER OFF steering switch located outboard of the throttle, is in the NORMAL position. In case of a malfunction, place the steering switch in the EMER OFF position to deactivate the steering system. When engaged, the nosewheel position is a function of the rudder pedal displacement, with a maximum of 45 degrees either side of center. Once the nosewheel casters beyond 45 degrees of center, it must be brought within 45 degrees of center with brakes before steering can be regained. When turns greater than 45 degrees are made from a standstill, it may be advantageous to use brakes only. NEW

When the steering switch is in the NORMAL position, the nosewheel is automatically centered and hydraulically locked with the arresting hook handle DOWN.

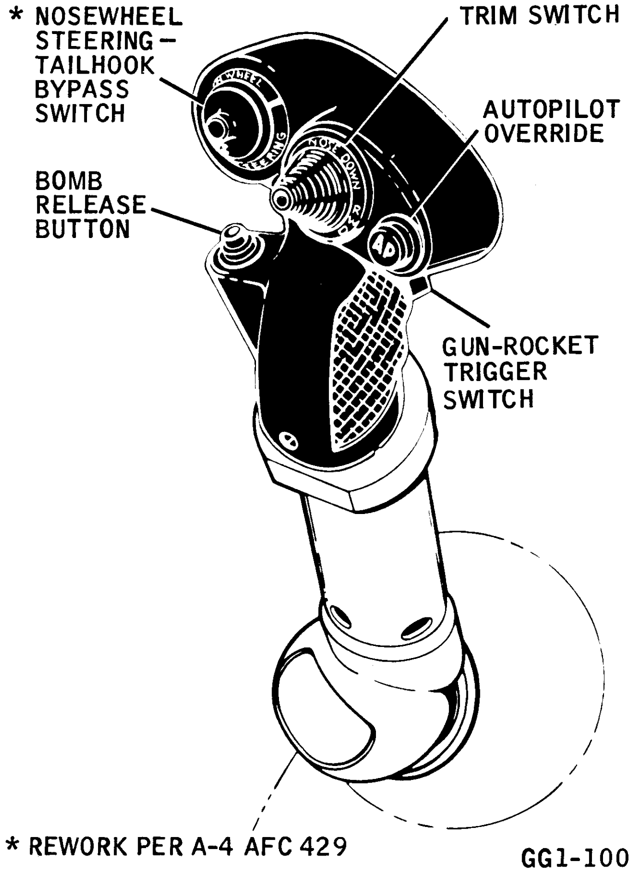


Figure 1-9A. Control Stick Switches

NOTE

- On A-4 aircraft reworked per A-4 AFC 421, the hydraulic center and locking feature is cut out with the hook handle down, but steering is available by actuating the nosewheel steering button.
- On A-4 aircraft reworked per A-4 AFC 429, the nosewheel is hydraulically centered and locked with the hook handle down, but steering is available by actuating the nosewheel steering button.
- On A-4 aircraft not reworked per A-4 AFC 421 or AFC 429, directional control is reduced with the hook handle down, but the following capabilities exist under good braking conditions:

  1. 0 to 30 KIAS – Aircraft cannot be steered but can be easily stopped using one brake.
  2. 30 to 70 KIAS – Aircraft may be steered by using the brakes.
  3. 70 KIAS and above – Aircraft may be steered by using the rudder.

When the hook handle is UP, the pilot regains nosewheel steering.

CAUTION

Because of the high residual thrust of the engine at IDLE, excessive taxi speeds may result while taxiing with nosewheel steering. Sharp turns made under this condition may cause loss of control and possible tipping of the aircraft onto its wing.

NOTE

Activation of the nosewheel steering system above 60 knots is not recommended during landing roll/takeoff run unless normal rudder/brake control is not effective. Energizing the system with the rudder pedals out of neutral or centered position will result in unexpected swerving.

Full right rudder trim of 8 degrees limits the steering angle of the nosewheel to 23 degrees right, but does not limit the steering angle to the left. Full left rudder trim of 8 degrees limits the steering angle of the nosewheel to 23 degrees left, but does not limit the steering angle to the right. Any left or right rudder trim will limit the nosewheel travel in the direction of trim.

WING SPOILERS

NEW

The spoilers are hydraulically actuated and electrically controlled by the spoiler ARM-OFF switch (figures FO-1 and FO-2) on the left console outboard of the throttle. Utility hydraulic pressure will extend the spoilers only when: (1) the ARM-OFF switch is positioned to ARM, (2) the left main landing gear oleo is compressed, and (3) the throttle position is below 70 percent rpm. Two linear ball lock actuators prevent the spoilers from creeping open in flight.

WARNING

The spoilers operate rapidly and with great force. Be certain all personnel are clear prior to spoiler actuation.

In-flight actuation of the spoilers is not likely because of the solenoid switch on the left landing gear which permits spoiler operation only when the weight of the aircraft is on the main landing gear strut. The spoilers will immediately dump to a faired position during a touch and go or bolter when the throttle position is advanced above 70 percent rpm.

NOTE

- Spoilers will not actuate when the aircraft is operating on emergency generator.
- When spoilers are actuated with the engine in idle rpm range, the hydraulic pressure decreases and may cause the utility system ladder light to flash momentarily.

SPEEDBRAKES

Two flush-mounted speedbrakes (figure 1-4), one on each side of the fuselage, provide deceleration during flight. Hydraulically operated speedbrakes are electrically controlled by the speedbrakes switch on the inboard side of the throttle grip. Movement of the switch to either OPEN or CLOSE actuates a solenoid valve which controls the flow of hydraulic pressure to the speedbrake actuating cylinders. The speedbrakes cannot be stopped at intermediate positions between fully opened and fully closed.

The SPD BRK OPEN warning light, located on the caution panel (figures FO-1 and FO-2) comes on whenever the speedbrakes are in any position other than fully closed. A blowback feature allows the speedbrakes to begin closing when the hydraulic pressure exceeds the pressure at which the blowback relief valve opens (3650 psi), thus preventing damage to the speedbrake system. The speedbrakes begin to blow back at approximately 490 KIAS. The speedbrakes will not open fully above 440 KIAS.

Three flush-mounted JATO hooks are attached to each speedbrake for mounting a JATO bottle for assisted takeoffs.

NOTE

When JATO bottles are attached to the speedbrakes, an interlock in the speedbrake electrical circuit will prevent the speedbrakes from opening when the speedbrake is in OPEN position. Ensure that the speedbrake switch is in the CLOSED position prior to takeoff to prevent inadvertent opening of the speedbrakes when the JATO bottles are jettisoned.

Speedbrake-Elevator Interconnect

A speedbrake-elevator interconnect spring minimizes aircraft pitchup during speedbrake actuation by automatically providing nosedown elevator when the speedbrakes are opened.

Emergency Speedbrake Control

The aircraft is equipped with an emergency speedbrake solenoid valve override control. The emergency speedbrake control (figures FO-1, FO-2, FO-6, and FO-7), a push-pull knob located at the aft end of the left-hand console, can be used to open or close the speedbrakes in the event of dc electrical failure, or failure of one of the speedbrake control valve solenoids. The emergency speedbrake control knob is held in a neutral position by a spring bungee and must be pulled up or pushed down to open or close the speedbrakes, respectively.

In the event of electrical failure, the speedbrakes may be opened or closed by momentary operation of the emergency speedbrake control push-pull knob.

CAUTION

When JATO bottles are installed, operation of the emergency speedbrake control will force the JATO bottles off the aircraft resulting in airframe damage.

WING SLATS

Aerodynamically controlled slats installed on the leading edges of the wings improve airflow characteristics over the wing at high angles of attack, primarily during approach and landing. The wing slats open and close independently and automatically as the aerodynamic loading dictates. Because so many variables - airspeed, gross weight, and applied load factor - affect the operation of the wing slats, no fixed airspeeds can be established at which the slats begin to open or close. In general, however, the slats begin to open below 200 KIAS, and are fully open at stalling speed.

Barricade Strap Detents

Three barricade strap detents (figure 1-4), installed on each leading edge, ensure proper barricade engagement. Two detents are spaced evenly on the wing slat; the third on the leading edge of the wing, inboard of the slat.

VORTEX GENERATORS

To combat buffet and random wing drop at high altitude, vortex generators, which are small metal vanes set at various fixed angles relative to the normal airflow, are installed along the slats and on the upper surface of the wing.

ARRESTING HOOK

An externally mounted arresting hook (figure 1-4) is installed on the lower aft fuselage. Retraction and extension of the hook are accomplished by a pneumatic-hydraulic holddown cylinder in the aft engine compartment. The holddown unit is essentially a reservoir which is divided into two chambers by a relief valve and orifice arrangement. The upper chamber is filled with hydraulic fluid to the full level and then charged with compressed air to 900 ±50 psi with the hook retracted. The lower chamber contains the actuating piston which is attached to the arresting hook. Utility hydraulic system pressure is applied to the lower side of the piston to effect retraction of the arresting hook, which is then held in the retracted position by a mechanical latch. Compressed air pressure and the weight of the arresting hook cause extension when the latch is released. With the arresting hook extended, the relief valve and orifice provide snubbing action to keep the hook on the deck during arrested landings by restricting the flow of fluid between the lower and upper chambers of the holddown unit when external forces tend to bounce the hook toward the retracted position.

Arresting Hook Handle

An arresting hook handle (figures 1-5 and 1-6) on the right cockpit rail controls the operation of the arresting hook. When the handle is moved to DOWN, the arresting hook is manually unlatched, allowing pressure from the holddown unit and the force of gravity to extend the hook.

CAUTION

The arresting hook handle should be firmly placed into position, not flipped nor slammed.

A light in the arresting hook handle comes on when the handle is moved to DOWN and goes off before the hook reaches the fully extended position. The UP position of the handle manually positions the arresting hook control valve so that utility hydraulic fluid at 3000 psi flows into the lower part of the arresting hook holddown cylinder overriding the air pressure, and causing the hook to be retracted and latched against the lower surface of the fuselage. The

arresting hook system employs a fail-safe feature which allows the hook to be extended in the event of cable system failure or hydraulic pressure failure.

When the utility hydraulic pressure is lost, compressed air pressure and the weight of the arresting hook will cause the hook to extend when the arresting hook handle is moved to the down position. However, the pilot cannot retract the arresting hook without hydraulic pressure.

Should the arresting hook control cable part, the uplatch will be released allowing the hook to move to the down position.

WHEEL BRAKES

Single disc (all A-4E aircraft not reworked per A-4 AFC 272) and dual disc (all A-4F aircraft and A-4E aircraft reworked per A-4 AFC-272) spot-type brakes are installed on the main wheels only. The brake system includes a separate hydraulic reservoir (figures FO-6 and FO-7) located in the nose section of the aircraft. Two master brake cylinders, operated by toe pressure on the upper part of the rudder pedals, provide the pressure necessary for operation of the brakes.

NOTE

The wheel brakes are a completely independent hydraulic system. Accordingly, the pilot should realize that he will have brakes even with complete hydraulic system failure.

COCKPIT ENCLOSURE

The cockpit enclosure consists of a fixed, three-piece windshield and a hinged clamshell canopy. The two windshield side panels are of molded plastic, and the center panel is constructed of alternating layers of glass and vinyl.

Canopy

The cockpit canopy is hinged at the aft end and moves back and up when opened. When closed, the canopy is held in place on both sides of the canopy rail by latch hooks which engage fixed rollers on the cockpit rails. An air bungee cylinder (figure 1-27), mounted aft of the ejection seat, counterbalances the canopy during normal operation and provides snubbing action. The canopy is closed by grasping the ledge on either side and by pulling down, overriding the air bungee cylinder pressure. The canopy may then be closed and locked by moving the canopy lever forward. Confirmation of the canopy being closed and latched can best be made by ensuring that the canopy handle snaps forward when the mechanism is in the overcenter position and by checking latches for proper hook engagement.

Canopy Controls

CANOPY LEVER

The canopy lever (figure FO-1 and FO-2) on the left console, is mechanically linked to the canopy mechanism. Moving the lever forward slides the canopy forward, causing the latch hooks to engage the latch rollers. Moving the lever aft slides the canopy aft, disengaging the latch hooks and allowing air bungee pressure to open the canopy. The canopy mechanism includes an overcenter device, which causes a noticeable increase in lever load as the lever approaches the locked position. This load drops off abruptly as the lever is moved past the overcenter position to the locked position. If the lever load does not drop off as the handle is moved overcenter, canopy rigging should be checked.

EXTERNAL CANOPY RELEASE HANDLE

An external canopy release handle (figure 5-14), which can be reached from the ground, is set flush in the left side of the fuselage below the cockpit. Pulling the external canopy release handle out and forward unlatches the canopy, allowing it to open in the normal manner. To be closed and locked from the outside, the canopy must be manually held down and the external handle moved aft and in until it is flush with the fuselage.

Interior Canopy Jettisoning

CANOPY-JETTISON HANDLE

The canopy may be jettisoned by pulling the canopy-jettison handle (figures 1-5 and 1-6) on the right side above the console. At airspeeds of 125 knots or above, the canopy will shear when it is opened by the normal canopy opening lever. However, use of the canopy-jettison handle to jettison the canopy is recommended. When the canopy-jettison handle is pulled, the canopy slides slightly aft to unlatch, swings open, and shears at the hinges. To fire the initiator, the

canopy-jettison handle must be pulled with a force of 20 to 35 pounds. The handle will extend three-quarters of an inch and then fall free after the initiator has fired.

WARNING

When canopy is jettisoned in flight by any means, rapid rearward movement of manual canopy lever occurs as wind raises and shears canopy. To avoid possible injury, ensure that hand and arm are clear of this area during canopy-jettison.

CANOPY-JETTISON SAFETY PINS

To prevent the cockpit enclosure air bungee from being inadvertently fired while on the ground, safety pins are provided for the canopy-jettison initiators and are connected by a red streamer stenciled REMOVE BEFORE FLIGHT.

Exterior Canopy Jettisoning

An emergency canopy-jettison handle (figure 5-14) is provided on each side of the fuselage, just forward of the wing root, for jettisoning the canopy during rescue. The control is a red handle, marked PULL CANOPY JETTISON, and is installed in a recess behind a spring-loaded door. The door is pointed out by a RESCUE arrow. When the door is pushed in, the handle extends and may be grasped and pulled to fire an initiator, which in turn activates a nitrogen bottle causing high-pressure nitrogen to escape into the air bungee cylinder. The canopy will jettison regardless of position.

NOTE

- To jettison, canopy must be closed on A-4E aircraft not reworked per A-4 AFC 204 (nitrogen bottle).
- Seat catapult is armed after jettisoning the canopy.

UNDERWATER CANOPY-JETTISON RELIEF VALVE

The aircraft has an underwater canopy-jettison relief valve which allows water to flow into the cockpit after a ditching. The relief valve installation is a circular insert in the outer skin on the left side of the fuselage, alongside the ejection seat just under the canopy rail. The relief valve is a door, normally sealed and held in place by a torsion rod, and is designed to open when the outside water pressure head is approximately 2 psi. The flow of water into the cockpit reduces the effective pressure head on the canopy. To open the canopy underwater, use of the CANOPY-JETTISON handle is recommended, as it will provide maximum power at the bungee. The use of the manual CANOPY lever should be considered an alternative, last resort method of underwater canopy opening.

ESCAPAC 1 EJECTION SEAT SYSTEM

Effectivity: All A-4E aircraft not reworked per A-4 AFC 359.

The aircraft is equipped with a rocket catapult seat (figure 1-10) which utilizes rocket thrust to propel the seat from the aircraft. The seat provides ground level escape capability during takeoff and landing emergencies at 90 KIAS and above. It also provides safe escape throughout the remainder of the flight envelope of the aircraft except for very unusual flight conditions such as inverted flight or steep angles of bank or dives at low altitudes (figure 5-4). The seat accommodates a back-type parachute, a modified PK-2 pararaft kit and seat pan, and is designed for use with an integrated torso harness. A nonadjustable headrest is part of the seat structure and houses the face curtain. The front surface of the seat bucket serves as a buffer for the calves of the legs, and the sides of the bucket extend above the pilot's thighs to protect the legs and minimize flailing during high speed ejection. The ejection sequence is started by pulling the face curtain with both hands over the helmet in front of the pilot's face. The sequence may also be started by pulling the alternate ejection handle. Partial travel of the face curtain jettisons the canopy and removes the canopy interlock. This allows the face curtain further travel, firing the catapult which ejects the seat. As the seat travels up the guide rails, the bailout oxygen bottle is actuated, and with zero-delay lanyard (ZDL) installed, the automatic barometric parachute actuator is armed. The seat also contacts a striker plate which trips the harness-release actuator sear and causes the harness-release actuator to fire. After a 1.0-second delay, the harness-release actuator automatically frees the seat belts and shoulder harness, releases the face curtain, and inflates the separation bladders which separate the pilot from the seat. The automatic barometric parachute actuator is armed at seat separation if not previously accomplished by ZDL. The delayed action of the harness-release actuator provides protection for the pilot, retaining him in the seat during the period of ejection. The parachute is equipped with an automatic barometric parachute actuator which incorporates a 2-second delay feature (MK 5 MOD 0 cartridge) to prevent premature opening of the parachute. Premature opening of the parachute could cause damage to the parachute from high velocity windblast and severe opening shock to the pilot. During the delay period, the pilot and seat will decelerate to a speed where the stresses placed upon the

pilot and parachute are reduced from the critical stage. As the pilot descends below 14,000 feet or if ejection occurs below 14,000 feet, the parachute is opened automatically at the end of the delay period.

Other features of the rocket catapult ejection seat include a load limiting energy absorbing device to reduce the possibility of back injuries from survivable crashes or hard arrested landings. An alternate ejection control handle (to be used when conditions prevent the pilot from reaching the face curtain) is located on the seat bucket between the pilot's legs. An ejection control safety handle, located in the center of the headrest, locks the ejection mechanism in a safe condition during ground operation. A dual strap inertia reel allows for mobility while seated. A cartridge indicator is incorporated in the harness release actuator allowing the pilot to visually check for cartridge installation.

ZERO-ZERO ESCAPE SEAT SYSTEM

Effectivity: All A-4E aircraft reworked per A-4 AFC 359.

The aircraft is equipped with a rocket catapult seat which utilizes rocket thrust to propel the seat from the aircraft. The system provides ground level at zero airspeed (zero-zero) escape capability (figure 5-6), as well as ground level escape at 90 knots with 45 degrees of roll, inverted flight escape at 320 feet above ground at 90 knots, and at wings-level ground impact at flight speed range with sink rates to 2000 feet per minute.

The parachute assembly includes survival equipment, PK-2 seat pan with oxygen bottle, and a ballistically-spread, 28-foot diameter back parachute which is designed to inflate in less than 1.5 seconds after pack opening. An overhead ejection handle is positioned over the pilot's helmet. Seat bucket sides are extended to minimize leg flailing during high speed ejection. The ejection seat stabilization system (Dart), for proper trajectory control, is an integral part of the zero-zero escape seat system.

Ejection Sequence

Ejection sequence of action is canopy unlock, canopy separation, seat ejection, seat-pilot separation, and parachute inflation (figure 5-5). The ejection sequence is started by pulling the face curtain, with hands in front of the pilot's face reaching over the helmet. The sequence may also be started by pulling the alternate ejection handle (located between the pilot's knees). Partial travel of the face curtain jettisons the canopy and removes the canopy interlock, allowing further face curtain travel; in turn, firing the rocket catapult which ejects the seat.

In the event canopy should fail to jettison when pulling either ejection seat handle, pull the CANOPY-JETTISON handle, located on the right-hand cockpit rail aft of the instrument panel. Continue pulling either ejection seat handle (face curtain or alternate ejection) to affect seat ejection. As seat travels up the guide rails, the bailout oxygen bottle is actuated, acceleration forces draw pilot's legs against front panel of seat, and harness release actuator sear hits striker plate on guide rail firing MK 86 MOD 0 delay cartridge.

As the seat nears top of guide rails, subsequent to hose (anti-g and oxygen) breakaway and with pilot on emergency oxygen, the rocket sustainer ignites the rocket catapult. The Dart is actuated and angular error in pitch and roll are sensed and corrected during the rocket burn. At rocket burnout (seat approximately 35 feet from cockpit), the nitrogen bottle inflates the back bladder, then the seat bladder, and both firing control release and subsequent seat-pilot separation, are accomplished.

As the seat moves away from the pilot, an arming cable is pulled and the external pilot chute (external) is deployed from its pouch. At speeds below 120 KIAS the external pilot chute will ensure immediate deployment of the main recovery chute, because of its inflated condition at pack opening. At speeds above 120 KIAS (figure 5-7), the external pilot chute will blow off because of an integral weak link in the bridle assembly and the internal pilot chute will initiate deployment of the main recovery parachute.

In addition to the snubbing lines separation system, a backup MK 86, MOD 0 cartridge fires 1 second after ejection, accomplishing seat-pilot separation. Three-quarters of a second after seat-pilot separation, a MK 4 MOD 1, 3/4-second delay cartridge will function, provided altitude is less than 14,000 feet MSL.

WARNING

If the parachute pack does not open, pilot shall physically actuate (pull) ripcord, located on left riser.

NOTE

After pack opening, the external pilot chute will rapidly deploy main recovery parachute.

Prior to parachute suspension line stretch, the ballistic skirt-spreader is actuated and the main recovery

chute mouth will open. After approximately 3/4 second, the main recovery parachute reaches full-open inflation.

NOTE

- If a ballistic failure occurs in the fail-safe spreading gun, the gun will release slugs for an aerodynamic inflation.
- In cases of ejection over water, the pararaft kit, attached to underside of seat pan assembly and containing survival supplies, can be manually inflated.

ESCAPAC 1C-3 EJECTION SEAT SYSTEM

Effectivity: A-4F aircraft

The A-4F aircraft is equipped with an ESCAPAC 1C-3 ejection seat. The seat utilizes rocket thrust to provide escape capability from zero speed and zero altitude throughout the entire aircraft flight profile except for very unusual flight conditions such as inverted flight, steep angles of bank, or dives at low altitudes. The seat accommodates a back-type parachute and a RSSK-8A survival kit, and is designed for use with an integrated torso harness. A non-adjustable headrest is part of the seat structure and houses the face curtain. The front surface of the seat bucket serves as a buffer for the calves of the legs, and the sides of the bucket extend above the pilot's thighs to protect the legs and minimize flailing during high speed ejection. The ejection sequence is started by pulling the face curtain over the helmet and past the face with both hands, or by pulling the alternate ejection D-handle on the seat between the pilot's legs. This jettisons the canopy and initiates the power retract mechanism on the inertia reel, pulling the pilot to the proper sitting position for ejection. As the seat travels up the guide rails, the emergency oxygen bailout bottle is actuated and the zero-delay arming lanyard arms the automatic barometric parachute actuator. The seat contacts a striker plate which trips the harness release actuator sear and fires the actuator after a 1-second delay. When the 1-second delay cartridge fires, the harness release actuator automatically releases the seat belt, shoulder harness, face curtain, alternate ejection handle, and inflates the separation bladders which separate the pilot from the seat.

The delayed action of the harness release actuator provides protection for the pilot by keeping him in the seat during the ejection period. The zero-delay arming lanyard initiates a 2-second delay cartridge in the automatic barometric parachute actuator. The 2-second delay prevents premature parachute opening that could cause damage to the parachute and severe shock to the pilot from high velocity windblast. During the delay period, the pilot and seat will decelerate to a speed where the stresses placed upon the pilot and parachute are reduced from the critical stage. As the pilot descends below 14, 000 feet or if ejection occurs below 14, 000 feet, the parachute is opened automatically at the end of the delay period.

Other features of the rocket catapult ejection seat include a load limiting energy absorbing device to reduce the possibility of back injuries from survivable crashes or hard arrested landings. An alternate ejection control handle (to be used when conditions prevent the pilot from reaching the face curtain) is located on the seat bucket between the pilot's legs. An ejection control safety handle, located in the center of the headrest, locks the ejection mechanism in a safe condition during ground operation. A dual strap inertia reel allows for mobility while seated.

Functional Components

HARNESS-RELEASE ACTUATOR

The harness-release actuator is essentially a cylinder containing a piston, a slow burning MK 86 MOD 0 cartridge, and a firing mechanism. The firing mechanism is spring loaded and is held in a safe position by a sear in the firing pin assembly. The actuator piston rod is connected to a bellcrank attached to the seat structure. Thus, when the seat is ejected, the actuator arming pin sear is tripped by the striker plate allowing the firing mechanism to detonate the cartridge which, 1.0 second later, exerts enough force to actuate the piston. The piston extends and rotates the bellcrank causing the seat belts, shoulder harness, and face curtain (or alternate ejection handle) to pull free, and puncture the nitrogen storage bottle releasing pressure to the separation bladders, thus separating pilot and seat.

AUTOMATIC BAROMETRIC PARACHUTE ACTUATOR

Parachutes used with the integrated torso harness are equipped with a barometrically controlled parachute actuator. The actuator is designed to deploy the parachute automatically at a predetermined altitude, in the event of pilot incapacitation. The actuator provides a 2-second delay before opening the parachute after reaching the preset altitude. When ejection is made below, at, or slightly above, the altitude for which the actuator is set, the delay allows the pilot to decelerate prior to parachute opening, thus reducing or eliminating pilot injury or parachute damage from opening shock. The delay also prevents the parachute from fouling on the seat when ejection is made at altitudes below that for which the actuator is set, where deployment would occur immediately upon separation from the seat. The automatic parachute actuator interferes in no way with the manual parachute release ripcord grip (D-ring) which may be pulled at any time to open the parachute.

An arming pin is inserted through the actuator mechanism to prevent inadvertent release of the parachute during normal operation when the aircraft descends through the altitude for which the actuator is set. The arming pin is anchored by the automatic parachute actuator arming lanyard to the harness-release handle. The arming pin is pulled by the ZDL, and the actuator is armed as the seat moves up the guide rails. If the automatic harness-release mechanism fails to operate and the harness-release handle is used to free the pilot from the seat, the parachute should deploy automatically since the actuator was armed by ZDL.

NOTE

All A-4 aircraft are equipped with the ZDL as an integral part of the ejection system.

SEAT ATTACHMENTS

The pilot is held in the seat by attachments to the integrated torso harness. This torso harness incorporates within its structure a seat belt, shoulder straps, and a parachute harness, thus leaving the pilot with few of the usual encumbrances. The shoulder harness straps are sewn to the parachute risers and attach to the inertia reel connection just below the headrest. The loose ends of the parachute risers have quick-disconnect fittings which engage other fittings that extend from the front shoulders of the torso harness. Short seat belts, which are sewn to the parachute harness on each side, and attached to the seat structure at the aft corners of the seat bucket, are adjustable in length. The loose ends of the seat belts have quick-action fittings which engage fittings protruding from the hip region of the torso harness.

SEAT CONTROLS

SEAT SWITCH. The seat is electrically adjusted in the vertical plane by movement of the three-position seat switch located on the miscellaneous switches panel (figures FO-1 and FO-2) to either UP or DOWN, and is stopped at the desired position by releasing the switch to the center or off position.

SHOULDER HARNESS INERTIA REEL CONTROL. The shoulder harness inertia reel control handle (figures 1-10 and 1-11), on the left side of the seat bucket, locks the inertia reel drum to prevent playout of the webbing from the inertia reel. When the control is in the LOCKED position, the shoulder harness will not extend and the pilot's freedom of movement is restricted.

The UNLOCKED position allows the shoulder harness to extend or retract as the pilot moves about. The reel will lock automatically if the aircraft is subjected to a deceleration in excess of 2.5±0.5g along the thrust line. This safety feature helps to prevent injuries if the shoulder harness is not locked prior to an arrested landing or a crash. If the inertia reel fails to unlock while any load is being applied to the cable, relax the load and recycle the handle.

HARNESS-RELEASE HANDLE. A D-handle (figures 1-10 and 1-11), labeled HARNESS RELEASE is mounted on the right side of the seat. A pin protrudes from the aft end of the handle, which extends down through the edge of the ejection seat to anchor the arming lanyard of the barometric parachute opener. A spring-loaded latch, which is grasped in conjunction with the harness release handle, retains the handle in the proper position and must be squeezed before the latter can be pulled. When the handle is pulled up, the barometric parachute opener lanyard and the shoulder harness and seat belt attachments are released from the seat, allowing the pilot to leave the cockpit with the parachute and survival kit still attached to the integrated torso harness.

NOTE

- Pulling the harness release D-handle releases the shoulder harness and lap belt end fittings, which cannot be reengaged in flight.
- Disconnect the barometric parachute opener arming lanyard from the harness-release handle before removing the parachute from the seat. If this is not done, the arming pin will be pulled and the parachute will open.

FACE CURTAIN. The face curtain screens the face from wind blast during ejection. In the A-4E aircraft, the face curtain ejection control handle adjusts automatically during vertical movement of the seat to maintain a suitable handle position relative to the pilot's helmet. In the A-4F aircraft, the face curtain ejection control handle (figure 1-11) should be manually adjusted prior to engine start to establish a suitable handle position relative to the pilot's helmet. It serves as a control for ejecting the seat and aids in supporting and positioning the pilot during ejection. The face curtain, which is housed in the headrest structure with the handle protruding, is mechanically connected to the canopy-jettison system and the seat

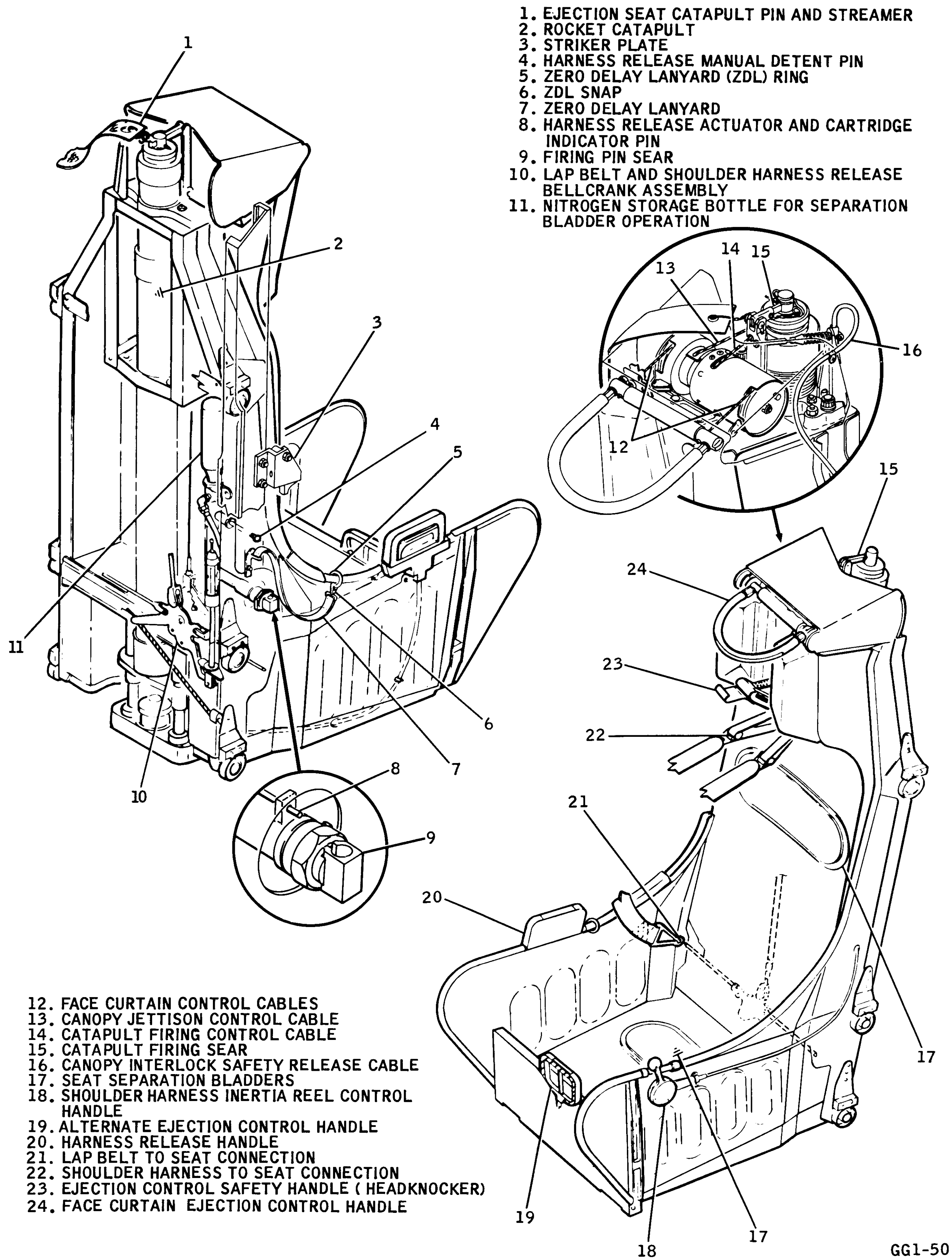
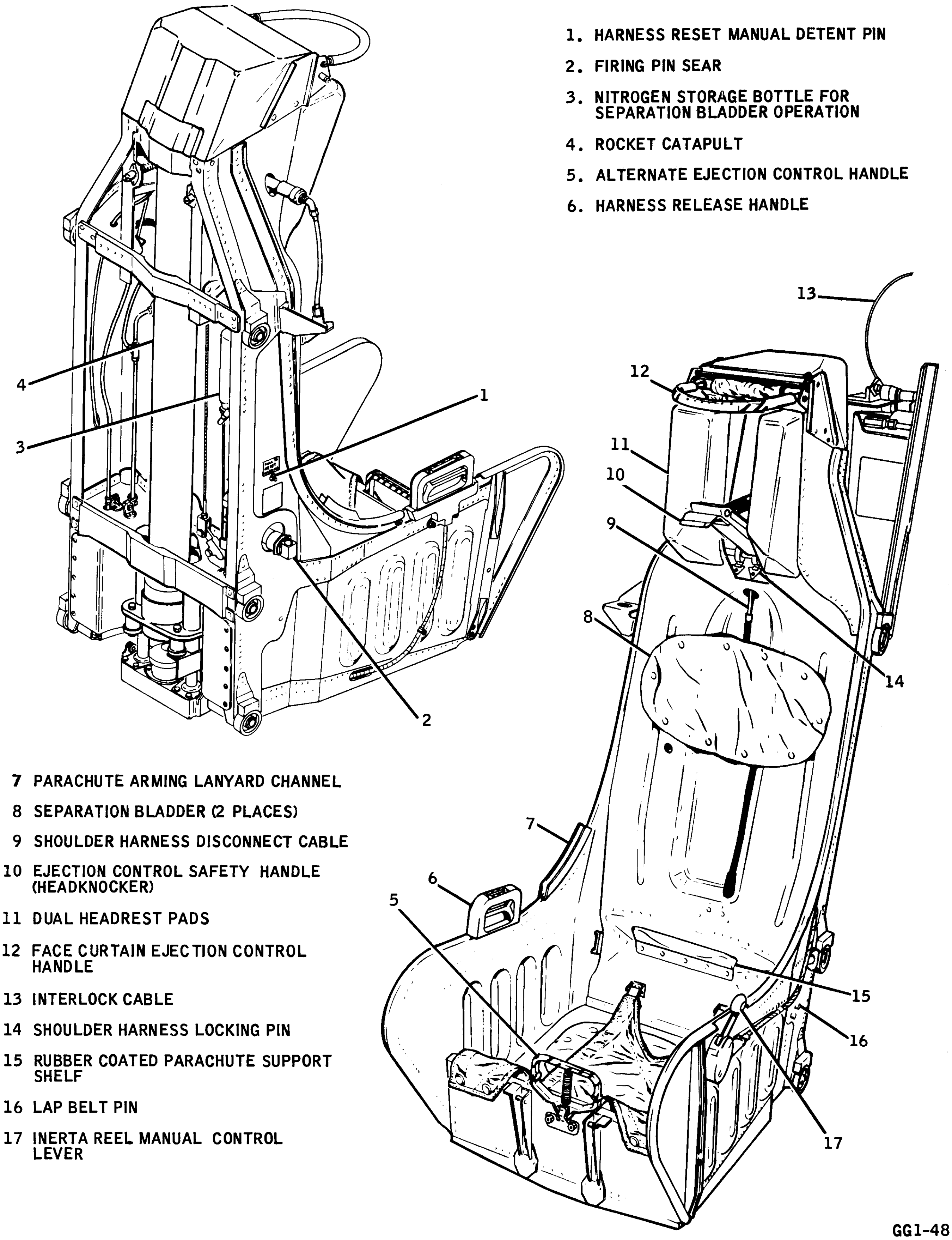


Figure 1-10. A-4E Rocket Ejection Seat



1. HARNESS RESET MANUAL DETENT PIN
2. FIRING PIN SEAR
3. NITROGEN STORAGE BOTTLE FOR SEPARATION BLADDER OPERATION
4. ROCKET CATAPULT
5. ALTERNATE EJECTION CONTROL HANDLE
6. HARNESS RELEASE HANDLE

7 PARACHUTE ARMING LANYARD CHANNEL
8 SEPARATION BLADDER (2 PLACES)
9 SHOULDER HARNESS DISCONNECT CABLE
10 EJECTION CONTROL SAFETY HANDLE (HEADKNOCKER)
11 DUAL HEADREST PADS
12 FACE CURTAIN EJECTION CONTROL HANDLE
13 INTERLOCK CABLE
14 SHOULDER HARNESS LOCKING PIN
15 RUBBER COATED PARACHUTE SUPPORT SHELF
16 LAP BELT PIN
17 INERTA REEL MANUAL CONTROL LEVER

Figure 1-11. A-4F Escapac 1C-3 Ejection Seat

catapult firing mechanism. When the face curtain is pulled downward, the first portion of travel jettisons the canopy and the last portion causes the seat to be ejected. The seat will not eject until the canopy is clear of the ejection path.

WARNING

Canopy jettisoning by means of partial face curtain extension should not be attempted since no positive stops are provided to prevent seat ejection after the canopy has jettisoned.

ALTERNATE EJECTION HANDLE. The alternate ejection handle (figures 1-10 and 1-11) is located on the forward side of the ejection seat between the pilot's legs. The handle is used to initiate the ejection sequence when use of the face curtain is not desirable or possible.

EJECTION CONTROL SAFETY HANDLE. The ejection control safety handle (headknocker), located between two rubber pads on the upper forward area of the seat assembly, functions as an ejection seat safety lock when in the down position. Locking is achieved in the A-4F aircraft by locking the firing control disconnect assembly and in the A-4E aircraft by securing the pulley mechanism; in turn locking the face curtain ejection control handle and alternate ejection control handle. The headknocker is identified with a "PULL OUT TO SAFETY EJECTION CONTROLS" decal. Moving the headknocker to the down position engages a locking pin into a locking drum, locking all movements of the ejection control pulley mechanism (A-4E) or firing control disconnect (A-4F). The headknocker cannot be moved to the up position (unlocking the ejection mechanism) until a safety lock is manually depressed, disengaging the lock.

NOTE

- Effectivity: All A-4F aircraft; A-4E aircraft reworked per A-4 AFC 310. Pull safety lockpin streamer before depressing the safety lock.
- The safety lock is visible only when the headknocker is in the down position. The safety lock is identified from above with a black and yellow checkerboard decal, providing visual verification that ejection controls are secured in the locked (headknocker down) position.

EJECTION SEAT STABILIZATION SYSTEM (DART)

Effectivity: All A-4F aircraft; all A-4E aircraft reworked per A-4 AFC 359

The ejection seat stabilization system counteracts the adverse effects of aerodynamics and seat system center-of-gravity variation. The system provides consistent and predictable trajectory during the rocket buring phase. The stabilization system is installed on the underside of the seat bucket and consists of two brake units, a deployable bridle arrangement, and four nylon draglines. Portions of the system lines are stowed in two fabric pouches mounted on the seat. The lines are routed through the brake units and through the eye of the bridle. At the eye, the remaining lengths of the system lines are gathered together and covered with a flame retardent sleeve. The covered section of line is stowed in a deployment pouch and the end is attached to the cockpit floor.

As the seat ejects, the slack line stowed in the deployment pouch pays out, and the bridle drops into position. At a preprogrammed distance, the system lines are pulled through the brake units developing a preprogrammed force in the lines and, consequently, a moment around the system center of gravity which counteracts any adverse rotation of the seat.

Ejection Sequence

Refer to section V for ejection sequence.

OXYGEN SYSTEM

Oxygen is supplied by a vacuum bottle liquid oxygen converter mounted in a vented compartment in the aft fuselage section. The converter filler valve is reached through an access door on the right side of the fuselage for servicing. The bottle contains 10 liters of liquid oxygen when serviced to capacity. Evaporation loss is constant when the system is not in use, and this loss is used to pressurize the system. By venting any excess pressure overboard through relief valves, pressure is maintained at 70±5 psi. Venting pressure may increase to 100±10 psi when the liquid oxygen system is not being used.

Liquid Oxygen Quantity Indicator

A liquid oxygen quantity indicator (figures FO-1 and FO-2) is located on the left center of the instrument panel, and is graduated with markings of 10, 8, 6, 4, 2, and 0. The quantity indicator is electrically operated and has a small OFF window to show that the indicator is inaccurate when electrical power is

lost. A red low level warning light on the indicator face comes on when the quantity falls below 1 liter. Depressing the TEST button on the instrument panel tests the operation of the liquid oxygen quantity indicator causing the needle to move counterclockwise. The low level warning light will come on when the needle passes the 1-liter mark. When the TEST button is released, the needle should return to its previous position.

Controls and Equipment

A lift-type toggle switch installed at the rear of the left console on the anti-g and oxygen panel (figures FO-1 and FO-2) places the oxygen system in operation when moved from OFF to OXY ON position.

When the oxygen switch is turned on, oxygen is delivered from the supply system at a pressure of 70 psi to the oxygen receptacle located on the oxygen and anti-g panel (figures FO-1 and FO-2) on the left console. The pilot's supply tube is plugged into the receptacle to allow the oxygen to flow to the oxygen mask regulator, installed just below the pilot's face mask. The mask regulator reduces the 70-psi converter oxygen pressure and delivers 100-percent oxygen to the mask under a positive pressure of approximately 1-inch water pressure at all cabin altitudes below 35,000 feet. At higher cabin altitudes, the delivered pressure is automatically increased to allow the pilot adequate oxygen absorption. The type A-13A face mask used with this oxygen system should be properly fitted to the pilot's face for best results. Relatively small leaks around a mask are cumulative in effect and result in considerable oxygen loss over long periods of operation. Always check the oxygen supply tubes for tight connections before moving the OXYGEN control to ON. Escaping oxygen creates a fire hazard in the presence of oil or grease.

Emergency Oxygen Supply

Emergency oxygen is contained in a U-shaped cylinder installed in the seat pan/survival kit. The cylinder pressure gage, visible through the upper surface of the forward corner of the seat pan/survival kit, should register 1800 psi when the cylinder is full. A pressure reducer allows oxygen to flow at 60 psi through the supply tube to the oxygen regulator for delivery to the face mask. The duration of the emergency supply is approximately 4 to 20 minutes, depending upon the altitude (the higher the altitude the longer the duration). NEW Emergency oxygen is supplied and normal oxygen is shut off to the mask when the emergency oxygen actuator assembly is activated. The manual release handle (green ring) is attached to the actuator assembly by a cable. A lanyard is also attached to the actuator assembly and to the aircraft through a quick-disconnect fitting. Pulling the green ring provides emergency oxygen at any time. When the seat is ejected or the pilot, still attached to his survival kit, leaves the cockpit, the lanyard attached to the aircraft initiates flow of emergency oxygen automatically.

Prior to flight, the following inspection should be made to ensure automatic supply of emergency oxygen during an emergency:

1. Check pressure gage for adequate supply (1800 psi).

2. Check that actuator lanyard (located on left console of A-4E; located on cockpit floor of A-4F) is attached to the aircraft.

3. With the mask-to-survival kit hoses connected and the console supply shut off or disconnected, check that there is no oxygen flow.

Oxygen Duration

Figure 1-12 is a tabulation of hours remaining for various altitude oxygen quantity combinations for the liquid oxygen supply system. It will be noted that although 100 percent oxygen is used at all times, duration is greater at high altitudes. Because the physical property of gases is affected by pressure, the volume of oxygen increases in direct proportion to the decrease in atmospheric pressure as altitude increases. Thus, while the volume of oxygen required by the pilot is approximately the same at any altitude, the oxygen delivered in reduced cockpit pressure is lower in density and less of the supply is required to satisfy the demand.

Normal Operation

BEFORE FLIGHT

Before each flight, the oxygen system and mask shall be checked for proper operation.

Connect the oxygen supply tube to the connector on the survival kit with the mask turned away from the face. Place the oxygen switch in ON. Listen for free flow of oxygen. Don the mask. Inhalation should be almost effortless if the regulator is delivering oxygen at a slight positive pressure. Exhalation should also be possible but will require some effort in order to close the inhalation valve.

NOTE

If exhalation is difficult, there is inhalation valve leakage.

LIQUID OXYGEN DURATION

10 LITER SYSTEM

DATA AS OF: 1 February 1962
DATA BASIS: Specification MIL-I-19326(Wep)

CABIN PRESSURE ALTITUDE -FEET-	HOURS REMAINING					
	GAGE READING (LITERS)					
	10	8	6	4	2	1
40,000 UP	60.6	48.5	36.4	24.2	12.0	4.8
35,000	37.0	29.6	22.2	14.8	7.4	3.6
30,000	27.2	21.8	16.4	10.8	5.4	2.8
25,000	20.4	16.4	12.4	8.2	4.0	2.0
20,000	16.0	12.8	9.6	6.4	3.2	1.6
15,000	12.8	10.2	7.6	5.2	2.6	1.2
10,000	10.0	8.0	6.0	4.0	2.0	1.0
5,000	8.4	6.6	5.0	3.2	1.6	0.8
SEA LEVEL	7.0	5.6	4.2	2.8	1.4	0.6

REMARKS:

(1) Based on 800 liters of gaseous oxygen per liter of liquid oxygen.

(2) Data assume the use of a properly fitted mask.

HH1-22

Figure 1-12. Liquid Oxygen Duration

DURING FLIGHT

Oxygen quantity should be checked periodically during flight. Separation of the oxygen hose couplings will be immediately apparent as oxygen flow and radio communication will cease.

FLIGHT INSTRUMENTS

The airspeed indicator, vertical speed indicator, and altimeter are connected to the pitot-static system. The attitude gyro, standby attitude gyro, bearing-distance-heading indicator (BDHI), angle-of-attack-system, and radar altimeter are electrically operated. The 8-day clock and accelerometer are independent of other systems in operation.

Airspeed Indicator

A combination airspeed indicator and Mach meter (figure FO-1 and FO-2) is located on the instrument panel. The airspeed portion of the dial is fixed in position, and is calibrated from 80 to 650 knots. The Mach meter scale is a rotating disc, marked from 0.50 to 2.9, turning beneath the airspeed dial. Only a portion of the disc can be seen through a cutout in the airspeed dial. Airspeed and corresponding Mach number are indicated simultaneously by a single needle pointer. On the Mach number disc is a movable index which is used to set a Mach reference by depressing and turning a set knob on the lower left corner of the instrument case. On the edge of the airspeed dial is an airspeed index pointer, which is adjustable through a range of 80 to 145 knots merely by turning the set knob.

Vertical Speed Indicator

A vertical speed indicator on the pilot's instrument panel (figures FO-1 and FO-2) is connected to the aircraft static air system and reflects the rate of change in static atmospheric pressure as the aircraft climbs or descends. This atmospheric pressure rate of change is represented in 100 foot graduations between 0 and 1000 feet, of ascent or descent, and in 500-foot graduations between 1000 to 6000 feet. The instrument can register ascents or descents too small to cause a variation in altimeter reading.

Altimeter

The pressure altimeter (figures FO-1 and FO-2) is calibrated from -1000 to +50,000 feet MSL. The dial face is marked in increments of 100 feet, each complete revolution of the pointer indicating change in

altitude of 1000 feet. On the left of the center of the instrument is a window containing two rotating counters; the inner counter registers altitude in thousands of feet, while the outer registers in ten thousands of feet. When the altimeter pointer makes 12 revolutions, for instance, the outer counter will indicate 1, and the inner counter will indicate 2, thus showing that the aircraft is at an altitude of 12,000 feet above sea level.

At the extreme right side of the altimeter face is the barometric pressure window. The barometric pressure dial seen through the window is marked from 28.10 to 31.00 inches of mercury, and used to correct for variations in sea level barometric pressure by means of a knob on the lower left corner of the instrument case.

Radar Altimeter

The AN/APN-141 radar altimeter (figures FO-1 and FO-2) employs the pulse radar technique to furnish accurate instantaneous altitude information to the pilot from 0 to 5000 feet terrain clearance. Aircraft height is determined by measuring the elapsed transit time of a radar pulse, which is converted directly to altitude in feet and displayed on the cockpit indicator. The indicator dial face is marked in 10-foot increments up to 200 feet, 50-foot increments from 200 to 600 feet, 100-foot increments from 600 to 2000 feet, and 500-foot increments from 2000 to 5000 feet. A control knob on the front of the indicator controls power to the indicator and is used for setting the low-limit indexer. It also provides for preflight and in-flight test of the equipment with a push-to-test type control knob feature. Refer to LOW ALTITUDE WARNING SYSTEM (LAWS) for information regarding low-limit indexer. An OFF flag on the indicator face appears when signal strength becomes inadequate to provide reliable altitude information, when power to the system is lost, or when the system is turned OFF.

CAUTION

Leave the AN/APN-141 radar altimeter in the OFF position until power is applied to the aircraft and return equipment to OFF before power is removed.

NOTE

At altitudes above 5000 feet terrain clearance, the OFF flag will appear and the pointer will move behind the masked portion of the indicator dial. The pointer will resume normal operation when the aircraft descends below 5000 feet.

The radar altimeter operates normally during 50-degree angles of climb or dive and 30-degree angles of bank right or left. Beyond these points, the indications on the radar altimeter become unreliable but will resume normal operation when the aircraft returns to normal flight.

Low Altitude Warning System (LAWS)

The low altitude warning system (A-4 AFC 333) consists of two cockpit warning lights (figures 1-5 and 1-6) and aural-warning tone operated in conjunction with AN/APN-141 radar altimeter.

When the APN-141 indicator needle moves below the preset indexer altitude, the marker-beacon light, the low-limit warning light, and aural-warning tone are activated for 2 seconds.

The altitude warning tone is an alternating 700- to 1700-cps tone monitored through the pilot's headset at a 2-cps repetition rate. A reliability warning signal of the same frequency range (but with 8-cps repetition rate) is also provided. The reliability warning signal sounds for 2 seconds whenever the APN-141 acquires or loses lock-on.

NOTE

On aircraft reworked per A-4 AFC 423, the reliability warning signal is removed.

AN/AJB-3 All-Attitude Indicator

Effectivity: Early A-4E aircraft

NEW

WARNING

- Indicator is unreliable if OFF flag is visible.
- It is possible to receive erroneous indications without the OFF flag showing

NEW

The aircraft is equipped with an all-attitude indicator located on the instrument panel (figure FO-1) which provides the pilot with a pictorial presentation of the aircraft pitch and roll attitude, plus heading information. Aircraft attitude reference signals are supplied to the indicator by electrical connection with the remotely mounted master reference platform. Pitch, roll, and heading are presented by the orientation of the all-attitude indicator sphere that provides the background for a miniature reference aircraft attached on the instrument face. The horizon is presented on the sphere as a white line dividing the top and bottom halves of the sphere. The upper half, symbolizing sky, is indicated by a light grey area above the horizon line; the lower half, symbolizing earth, is indicated by a dull black area below the horizon line. The sphere is graduated every 5 degrees in azimuth around the horizon line and every 30 degrees around the rest of the sphere. The

sphere is graduated every 10 degrees of climb and dive. The sphere is free to move a full 360 degrees in pitch, roll, or heading without obstruction. Bank angles can be read by reference to roll indices located around the periphery of the instrument lens.

A pitch trim knob, located on the lower right-hand corner of the indicator, with an index mark at its 10 o'clock position, controls the sphere pitch setting in relation to the reference aircraft. Adjustment can be made from 10 degrees noseup to 5 degrees nosedown. The indicator is calibrated to display, at any pitch angle, the true aircraft attitude (Armament Datum Line) in relation to the surface of the earth, with pitch trim knob aligned to the index mark. It is recommended that the pitch trim knob always be aligned to the index mark before flight and be left in that position throughout the flight. This will enable the pilot to always know his true attitude in relation to the surface of the earth regardless of the maneuver performed.

A maximum of 90 seconds may be required for gyro erection and amplifier warmup. Complete loss of electrical power to the gyro and/or indicator will cause the OFF flag to appear.

A combination g-programer and g-indicator is mounted on the left-hand side of the face of the all-attitude indicator for use with the indicator in performing loft bombing maneuvers.

AN/AJB-3A All-Attitude Indicator

Effectivity: All A-4F; late A-4E aircraft

NEW

WARNING

- Indicator is unreliable if OFF flag is visible.
- It is possible to receive erroneous indications without the OFF flag showing.

The AN/AJB-3A all-attitude indicator is located on the instrument panel (figures FO-1 and FO-2). The indicator provides the pilot with a pictorial presentation of the aircraft's pitch, roll, heading, and turn-and-slip. Aircraft attitude reference signals are supplied to the indicator by electrical connection with the remotely mounted master reference platform. Pitch, roll, and heading are shown by the orientation of the all-attitude indicator sphere with the miniature reference aircraft attached to the instrument face. An electrically powered bank inclinometer and rate-of-turn pointer, under the sphere on the attitude director indicator, completes the indicator presentation. The horizon is shown as a white line dividing the top and bottom halves of the sphere. The upper half, symbolizing sky, is a light grey area above the horizon line; the lower half, symbolizing earth, is a dull black area below the horizon line. The sphere is graduated every 5 degrees in azimuth around the horizon line and every 30 degrees around the rest of the sphere. The sphere is graduated every 10 degrees of climb and dive. The sphere is free to move a full 360 degrees in pitch, roll, or heading. Roll indices are located on the top and bottom of the indicator.

Several indicating flags and pointers are incorporated in the instrument that are not used by the AN/AJB-3A indicator. All flags and pointers are biased out of sight at the end of the 60-second start period, and only the horizontal and vertical director pointers, used in bombing, are later brought into view. (Refer to All-Attitude Indicator in A-4/TA-4 Tactical Manual NAVAIR 01-40AV-1T for a complete description of the horizontal and vertical director pointers.) The OFF flag disappears at the end of the 60-second start period and should not reappear until the system is turned off. If the OFF flag does appear, a power failure is indicated. A maximum of 90 seconds may be required for gyro erection and amplifier warmup.

The turn-and-slip indicators are located below the sphere and are an integral part of the all-attitude indicator. A one-needle width deflection of the turn indicator will result in a standard rate, 2-minute, 360-degree turn. Full deflection (two-needle widths) results in a 1-minute, 360-degree turn. The turn indicator is electrically driven and will operate on emergency generator.

A pitch trim knob, located on the lower right corner of the indicator, with an index mark at its 10 o'clock position, controls the sphere pitch setting in relation to the reference aircraft. Adjustment can be made from 10 degrees noseup to 5 degrees nosedown. The indicator is calibrated to display, at any pitch angle, the true aircraft attitude (Armament Datum Line) in relation to the surface of the earth, with pitch trim knob aligned to the index mark. It is recommended that the pitch trim knob always be aligned to the index mark before flight and be left in that position throughout the flight. This will enable the pilot to always know his true attitude in relation to the surface of the earth regardless of the maneuver performed.

GYRO CUTOUT SWITCH

Effectivity: All A-4F aircraft; A-4E aircraft reworked per A-4 AFC 258

A gyro cutout switch is located in the left-hand side of the forward engine compartment. In the normal position, maintenance and servicing requirements involving power application to the aircraft may be accomplished without energizing the AJB-3/3A system. Gyro damage will be prevented by allowing uninterrupted rundown subsequent to flight and preventing unnecessary brief turnups.

Standby Attitude Indicator

A remote indicating standby attitude indicator (figures FO-1 and FO-2) provides an alternate system for the all-weather instrumentation of the aircraft in the event of malfunction or failure of the all-attitude indicator.

CAUTION

Do not operate the fast erect switch longer than two minutes continuously. Extended operation may damage the circuitry.

A fast erect switch (figures FO-1 and FO-2) is provided to decrease the time required to erect the indicator. The fast erect switch has an erection rate of 30 degrees per minute.

Bearing-Distance-Heading Indicator (BDHI)

The BDHI (figures FO-1 and FO-2) displays magnetic heading by rotation of the compass card dial. Distance and relative/magnetic bearings, in relation to a ground or shipboard station, are also displayed by the instrument.

Magnetic heading information from the compass compensator adaptor is provided to the rotating compass card which indicates magnetic heading in degrees. A fixed index at the top of the indicator denotes the reference heading of the aircraft.

A central window in the indicator face shows a three-digit display, indicating distance in nautical miles for TACAN operation. An OFF flag is displayed when distance information is not present.

Displayed on the face of the indicator are two pointers, pointer 1 (a single-bar pointer for UHF/ADF operation) and point 2 (a double-bar pointer for TACAN). Both pointers will indicate relative and magnetic bearing information if the compass card is in synchronization (sync).

NOTE

Pointer 1 will always indicate relative bearing from the aircraft. However, if the compass card is out of sync, pointer 2 will follow the compass card and indicate magnetic bearing only.

Turn-and-Slip Indicator

Effectivity: Early A-4E aircraft

In aircraft incorporating the AN/AJB-3 system, a turn-and-slip indicator is located on the instrument panel (figure FO-1) which consists of a turn needle used to measure rate-of-turn and a balance ball used to indicate balanced (in trim) directional flight. The 4-minute turn needle deflects in the direction of turn. A turn which deflects the turn needle one needle width from center will result in a one-half standard rate turn (1 1/2 degrees per second). The balance ball, when centered, indicates balanced flight.

NOTE

In aircraft incorporating the AN/AJB-3A system (All A-4F aircraft, late A-4E aircraft), a 2-minute turn needle deflects one needle width from center, resulting in a standard rate turn (3 degrees per second) indication. The turn-and-slip indicator is an integral part of the AJB-3A indicator and is located at the bottom of the attitude director indicator sphere.

Accelerometer

An accelerometer (figures FO-1 and FO-2) with three indicating hands registers and records positive- and negative-g loads. One hand moves in the direction of the g-load being applied while the other two, one for positive-g loads and one for negative-g loads, follow the indicating pointer to its maximum travel. The recording pointers remain at the respective maximum travel positions of the g's being applied, providing a record of maximum g loads encountered. Depressing the push-to-reset knob at the lower left corner of the instrument, allows the recording pointers to return to the normal (1 g) position.

NOTE

Accelerometers may read as much as 1/2 g low; possibly lower if the pull-in rate is high.

Elapsed-Time Clock

An elapsed-time clock located at the top of the windshield has an 8-day mechanical movement and four concentrically mounted pointers: hour, minute, second, and elapsed time.

Eight-Day Clock

A clock is provided (figures FO-1 and FO-2) on the instrument panel.

Angle-of-Attack System

The angle-of-attack system consists of an angle-of-attack vane transducer unit, indicator, indexer light with dimming wheel, and a three-colored external approach lights unit (figure 1-13). The angle-of-attack vane extending outboard on the left side of the fuselage senses the attitude of the aircraft in relation to the relative wind and sends the angle-of-attack readings to the indicator located at the top of the instrument panel. The indicator has a pointer, a dial graduated from 0 through 30, and an OFF window. The dial is adjustable with respect to the fixed reference index at the 3 o'clock position on the case. Relative wind angle-of-attack information is relayed by cams and wiring from the indicator to the index light located just left of the gunsight for the pilot, and to the three-colored external approach lights unit for the landing signal officer. The angle-of-attack vane is not heated when operating on emergency generator with the landing gear extended.

ANGLE-OF-ATTACK INDEXER LIGHTS

The angle-of-attack indexer lights assembly, located on the top side of the glareshield in the cockpit (figure 1-5) and left of the gunsight, is in a single case containing three light bulbs behind a polaroid lens. On aircraft not reworked per A-4 AFC 456, the lens assembly shows all conditions in a red glow, compatible with night flying accommodation. On aircraft reworked per A-4 AFC-456 the lens assembly is of the tri-colored type, with the upper lens green, center lens yellow, and lower one red. Angle-of-attack indications are shown on the tri-colored light assembly by a chevron (V) at the top, a doughnut (O) at the center and an inverted (Λ) chevron at the bottom. Two intermediate conditions are also indicated on the lens, when approaching or departing optimum angle of attack, by showing the (O) simultaneously with the (V) or the (Λ) display. (See figure 1-13 for concise interpretation of INDEX CONDITIONS, with the corresponding color of the external approach light visible to the landing signal officer, LSO.) The light bulbs in the indexer are electrically connected through a dimming mechanism within the case to the index light transformer. Dimming of the lights is controlled by manual movement of a wheel, protruding from the face on the left side of the case, to provide suitable intensity for the operator pilot. Dimming is automatically provided when the exterior lights are turned ON. A press-to-test button, labeled TEST on the face of the instrument panel, is used to check the lighting integrity of the indexer by turning on all three light bulbs when the test button is depressed.

ANGLE-OF-ATTACK INDICATOR

The angle-of-attack indicator indicates units of angle of attack to the relative airstream, from 0 to 30 on the face of the dial. (These increments are not absolute but are arbitrary indicated units grouped around the optimum.) An OFF flag becomes visible when ac power is lost. The dial is adjustable by means of an allen wrench receptacle at the lower left-hand corner of the indicator to set the optimum unit setting at the 3 o'clock position. All switching is referenced to the 3 o'clock position regardless of dial setting. The recommended setting for landing approach is 17 1/2 units. If the angle-of-attack indication of 17 1/2 units does not produce the indicated airspeed for the configuration computed from figures 11-40 and 11-79, the flap setting should be checked. If the appropriate configuration is established, disregard the indicator and make the approach at the computed airspeed from figures 11-40 and 11-79.

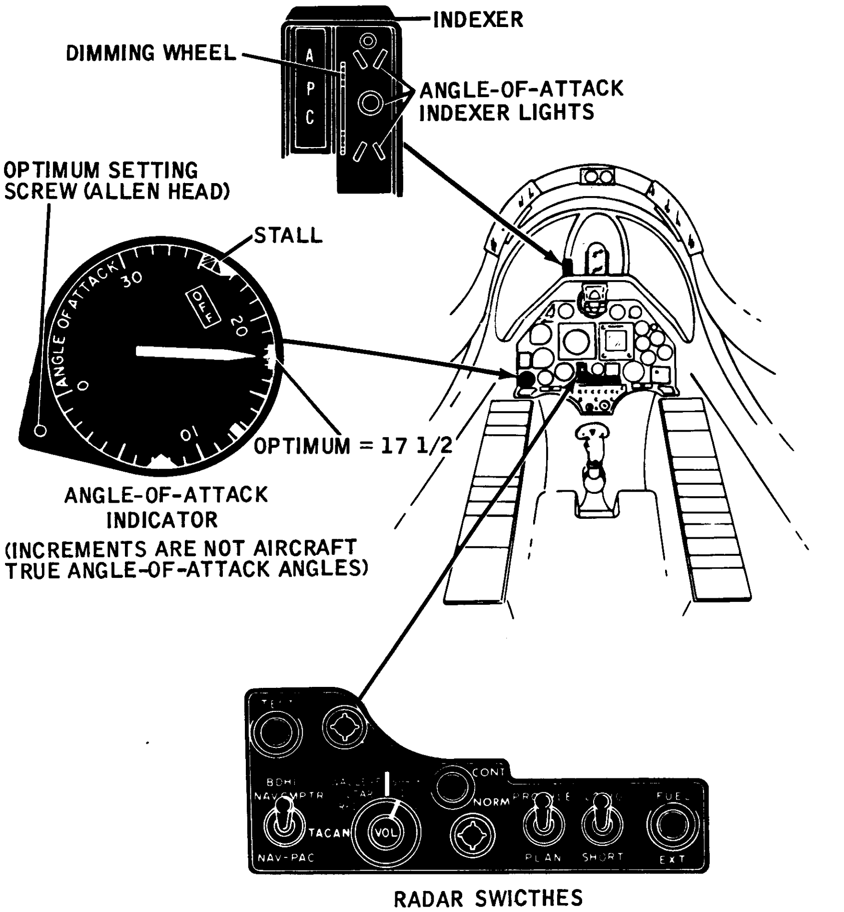
Four indices are positioned at various points around the dial. The main index represents the optimum angle of attack for approach to landing and is always placed in the 3 o'clock position. The stall index is set at 27 units near the 12 o'clock position on the dial. The triangular cruise index at the 5:30 o'clock position and the square climb index at the 4:30 o'clock position are not used because of variations in climb and cruise angles-of-attack in A-4 aircraft.

The recommended 17 1/2 units on the A-4F aircraft is consistent with 17 1/2 units on the A-4C and A-4E, and 19 units on the A-4B aircraft. At these recommended approach units, for equal gross weights, the approach airspeed and attitude with respect to horizontal will be equal on all A-4 series aircraft.

The angle-of-attack system may be used for cruise control if the airspeed system fails. It should be recognized that the angle-of-attack indications are inadequate to use as a prime cruise control system, since small variations result in relatively large changes in airspeed at optimum cruise. Sample angle-of-attack readings for this are indicated in the following:

Condition	Angle-of-Attack Cockpit Indicator Units
Maximum range climb	5.5 to 7.0
Maximum range descent or maximum endurance at all altitudes	9.5
Cruise at 5000 feet	6.5 to 7.0
Cruise at 35,000 feet	7.5 to 8.5
250-knot descent with speedbrakes extended	7.0

The above data are based on an aircraft configured with two 300-gallon external tanks. For aircraft



INDEX CONDITIONS
ANGLE-OF-ATTACK **TOO HIGH** (LIGHT = GREEN) (* INDICATOR = 18 1/2 - 30)
ANGLE-OF-ATTACK **HIGH** APPROACHING OR DEPARTING OPTIMUM (LIGHTS = GREEN-YELLOW) (* INDICATOR = 18-18 1/2)
ANGLE-OF-ATTACK **OPTIMUM** ("BULLSEYE") (LIGHT = YELLOW) (* INDICATOR = 17-18)
ANGLE-OF-ATTACK **LOW** APPROACHING OR DEPARTING OPTIMUM (LIGHTS = RED - YELLOW) (* INDICATOR = 16 1/2 - 17)
ANGLE-OF-ATTACK **TOO LOW** (LIGHT = RED) (* INDICATOR = 0-16 1/2)
* ONLY IF OPTIMUM SETTING IS 17 1/2 WITH DIFFERENT OPTIMUM SETTING, BREAK POINTS CHANGE CORRESPONDINGLY.

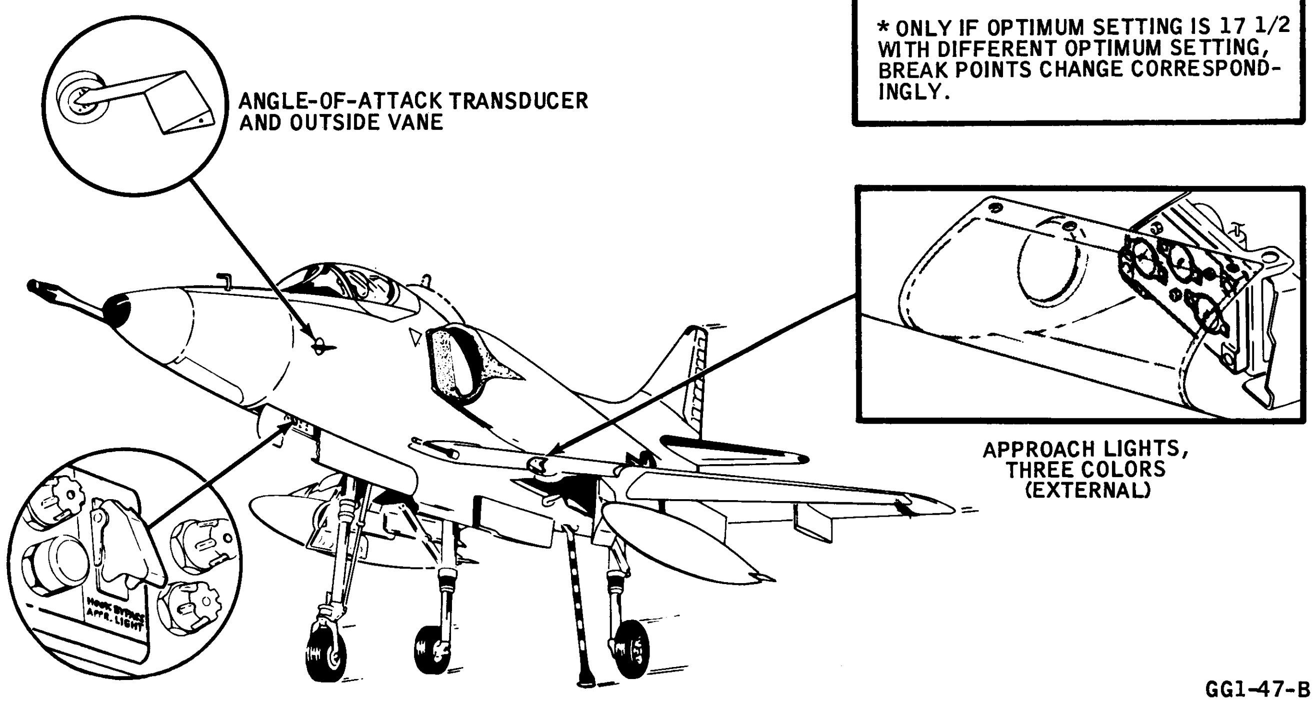


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Figure 1-13. Angle-of-Attack – Approach Light System

without external stores, these angle-of-attack indicator readings should be decreased 0.5 unit.

NOTE

When above speeds of 200 KIAS, an angle-of-attack error of 0.5 unit is equal to an airspeed error of 25 KIAS.

EXTERNAL APPROACH LIGHT

The external approach lights unit located in the leading edge of the left wing behind a transparent section has three separate lamps covered by red, amber, and green lenses. The corresponding angle-of-attack conditions are shown to the LSO, as green for angle of attack too high; as yellow for angle-of-attack optimum (or approaching or departing optimum); and as red for angle of attack too low.

The external approach lights are bright in the daytime and dim automatically when the master exterior lights switch is turned on for night flying.

The indicator in the cockpit will be in operation during the entire flight to present angle-of-attack information. The angle-of-attack transducer is also connected to AN/APG-53A/B radar system. The indexer lights and the external approach lights, powered by the ac primary bus, operate automatically when the landing gear is down and locked, the arresting hook is extended, and the aircraft is in flight or up on jacks. All approach lights go out, upon landing, by means of a landing gear strut compress switch (squat switch).

NOTE

External approach lights are operated through a dc approach light relay. The primary dc bus that operates the approach light relay will be inoperative and external approach lights will not be available with a dc electrical failure. If a dc fuse is the problem, dc power may be regained by dropping the emergency generator on A-4E aircraft reworked per AFC 411 and all A-4F aircraft.

APPROACH LIGHT ARRESTING HOOK BYPASS

A momentary contact toggle switch, labeled HOOK BYPASS, is located in the nosewheel well. This guarded switch is used to bypass the arresting hook circuit of the approach light system during field mirror landing practice. To provide approach lights during field landings without using the arresting hook, a ground crewman momentarily engages the HOOK BYPASS switch to the BYPASS position. The approach lights stay on as long as the landing gear is down and the landing gear struts are not compressed enough to actuate the struts compress switch (squat switch). Normal operation of the approach light circuit is re-established by moving the arresting hook handle to the DOWN position, or interrupting electrical power to the approach light circuit.

NOTE

If "bounce drill" on the carrier is conducted using the approach light arresting hook bypass, extra precaution must be taken to ensure that the arresting hook is extended before an arrested landing.

COMMUNICATIONS AND ASSOCIATED ELECTRONIC EQUIPMENT

Effectivity: All A-4E aircraft

General

All communications and associated electronic equipment is listed in figure 1-14. Major units of the AN/ARC-27A UHF radio, the AN/ARA-25 direction finder, and the AN/APX-6B IFF equipment are mounted in an integrated electronics central, which is designated AN/ASQ-17B and located in the nose section of the aircraft, along with the AN/APA-89 coder group. Also installed in the nose section is the AN/ARN-21B or the AN/ARN-52(V)TACAN radio. Auxiliary navigation equipment, the AN/ARN-14E VOR radio and the AN/ARN-12 marker beacon receiver, can be carried as an external store in a navigation package (NAVPAC). The function selector switch of the AN/ARC-27A UHF radio is used as a master radio switch, and must be turned on to apply power to the AN/ARC-27A, AN/ARA-25, or AN/APX-6B. In addition, each piece of equipment must be turned on at the associated control panel with the exception of the AN/ARN-12 marker beacon receiver (when NAVPAC is installed), which is energized when the main generator is operating or external power is applied to the aircraft.

NOTE

During ground operations in excess of 30 minutes close and lock canopy and place pressurization switch in NORMAL to provide cooling air to the AN/ASQ-17B electronics package.

Audio Isolation Amplifier

Effectivity: All A-4E aircraft reworked per A-4 AFC 333

The audio isolation amplifier is used to match the headset impedance with all receivers in the aircraft. A switch, located in the lower right corner of the instrument panel (figure FO-1), is labeled AUDIO BYPASS/NORM. The AUDIO BYPASS/NORM switch, when in the AUDIO BYPASS position, removes the audio isolation amplifier from the circuit and permits only the audio signals from the AN/ARC-51A, LAWS (low altitude warning system), and the SHRIKE to be heard.

not used). There are 4096 discrete codes available in Modes 2, 3/A, and C. Two special relay code configurations, EMER and IP (identification of position), are available. The emergency (EMER) code, selected by the pilot, is reported on Mode 1, 2, 3/A, as code 7700. The IP code is requested by the ground controller. Modes 2 and 3/A reply and are followed by a Special Position Identification (SPI) pulse. This pulse provides the air controllers with aircraft position upon demand.

AIMS EQUIPMENT. The AIMS system includes the following equipment and subsystems:

KIT-1/T-SEC computer transponder

AN/CPU-66A altitude computer

AN/APX-64(V) IFF Radar Identification Subsystem

KIT-1/T-SEC COMPUTER TRANSPONDER. The computer transponder provides Mode 4 coding and decoding capability, and MK XII IFF capability. Mode 4 video interrogations are received from the AN/APX-64(V) radar identification subsystem.

Output coding is applied to the AN/APX-64(V) transmitter. Codes A, B, or Zero may be selected on the C-6280 (P) APX transponder set control.

AN/CPU-66A ALTITUDE COMPUTER. The altitude computer receives air data inputs from static and pitot air supplied and converts air data inputs to servo and digital information proportional to aircraft altitude. Servoed outputs drive and AAU-19 altimeter, and digital outputs are routed to the AN/APX-64(V) radar identification subsystem, coded as Mode 3 replies, for transmittal to ground stations.

AN/APX-64(V) IFF RADAR IDENTIFICATION SUBSYSTEM. The IFF radar identification subsystem consists of an RT-728/AN APX-64(V) receiver-transmitter, a C-6280(P)/APX transponder set control, an IFF Mode 4 failure light, a TS-1843/A transponder inflight test set, and various antennas.

The TS-1843/A transponder inflight test set will, at the pilot's demand, check the transponder functions of R/T frequency, sensitivity and power, VSWR, coding, and decoding, and will display a GO, NO-GO indication to the pilot.

The subsystem provides automatic radar recognition of an aircraft when challenged by other surface or airborne systems, using specifically coded pulse interrogations. The subsystem provides for reception, detection, decoding, encoding, and transmission of signals. Provisions are also incorporated to enable an emergency reply to be transmitted to the transponder, irrespective of the mode being interrogated. Provisions are also incorporated to obtain the identification position (IP) of the aircraft being interrogated.

The subsystem can provide 4096 reply codes in Mode 3/A, as well as normal reply codes for Modes 1 and 2, and full Mode C altitude reporting. Sidelobe suppression is incorporated, enabling IFF equipment to have more precise azimuth information on aircraft operating at short ranges.

TACAN Bearing-Distance Equipment

The AN/ARN-52(V) TACAN airborne equipment operates in conjunction with surface navigation beacons to provide continuous directional and distance information to the pilot. Visual indication of magnetic bearing to a selected station is provided by the No. 2 pointer of the ID-663-BDHI (figures FO-1 and FO-2), and distance information to 300 miles is indicated in the range window. Beacon identification tone signals are received through the regular headset.

TACAN CONTROL PANEL

The control panel (figures FO-1 and FO-2), is identified as TACAN and is located on the right console. Operating controls include the power switch with OFF, REC, T/R, and A/A positions, two channel selector knobs, and a volume control. The REC and T/R positions give bearing information on the No. 2 needle of the ID-663 BDHI. In the T/R position, distance information in the range window of the instrument is also given. The A/A position gives air-to-air distance information between cooperative aircraft. Air-to-air (A/A) ranging requires cooperating aircraft to be within line of sight distance. This mode enables the TACAN installation to provide range indications between one aircraft and up to five others. TACAN displays normal range and azimuth information in the T/R mode and range information only in the A/A mode. (The azimuth indicator, No. 2 needle, rotates continuously.)

If A/A operation is desired between two aircraft, the channels selected must be separated by exactly 63 channels, i.e., No. 1 aircraft is set to channel 64, No. 2 aircraft is set at channel 1. Both aircraft must then select A/A mode on the TACAN function switch with the range between aircraft being displayed on the DME indicator. The maximum lock-on range is 300 miles. However, due to the relative motion of the aircraft, the initial lock-on range will usually be less.

If A/A operation is desired between one lead aircraft and five others, the channel selected by the lead aircraft may be 64, for example. The other five aircraft must be separated by exactly 63 channels, and would be on channel 1. The A/A mode must then be selected on the TACAN selector switch.

TACAN ANTENNA SWITCH

A three-position TACAN antenna switch (figures FO-1 and FO-2) is located on the outboard right console. The purpose of the switch is to enable the pilot to utilize the forward or aft antenna. The switch is labeled AUTO, FWD, and AFT. The AUTO position enables automatic selection of the antenna that permits station lock-on to be achieved.

TACAN TRANSFER RELAY

Because the ID-663 BDHI is common to both the AN/ARN-14E OMNI and the TACAN, a switching means is provided for the selection of proper receiver-indicator combinations to meet specific navigational requirements. The TACAN transfer relay is energized by either the REC or T/R position of the power switch on the TACAN control panel, automatically disconnecting the OMNI and connecting the TACAN to the BDHI. Thus, if both radio sets are inadvertently turned on at the same time, the TACAN bearing is the one that will be presented on the BDHI No. 2 needle.

OPERATION OF TACAN EQUIPMENT

To operate the TACAN radio, proceed as follows:

1. Power switch .... REC
2. After 3 minutes power switch T/R
3. Channel selector switch .... set channel selector
4. Station identification code will be audible in headset. Volume can be controlled by knob labeled VOL on the TACAN control panel.
5. BDHI NAV COMPUTER-TACAN-NAVPAC switch .... TACAN position
6. Magnetic bearing to station will be indicated on the No. 2 needle of the BDHI indicator.
7. For distance information, the power switch must be turned to T/R. Read slant range distance to the beacon in nautical miles in the range window of the BDHI indicator.

Automatic Direction Finding Equipment

Effectivity: All A-4E aircraft

The An/ARA-25 automatic direction finding equipment operates in conjunction with the AN/ARC-27A UHF radio to provide a continuous directional indication of the source of signals received in the 225- to 400-megacycle band. Source indication in relative bearing for homing or navigational purposes is provided by needle 1 of the ID-633 BDHI course indicator.

OPERATION OF THE AN/ARA-25

The AN/ARA-25 ADF equipment is energized when the aircraft electrical system is energized, and is placed in operation by moving the function selector

switch on the UHF radio control panel to the ADF position. When the UHF radio is left in the ADF position, transmission and reception are garbled.

NOTE

- When the emergency generator is extended, ARN-52(V), APX-6B, ARA-25, ARC-27A, and the compass system are the only navigational aids available to the pilot. ARN-52(V) is inoperative when the landing gear is DOWN.
- Excessive UHF-ADF bearing errors may result when stores are carried on centerline station.

Automatic Direction Finding Equipment

Effectivity: All A-4F aircraft

The AN/ARA-50 (ADF) radio navigation system supplies automatic direction finding indication from received UHF radio signals. The AN/ARA-50 system operates in conjunction with the AN/ARC-51A (UHF) radio communication system, the AN/ARR-69 (UHF) auxiliary receiver system, and the ID-663 BDHI bearing, distance, and heading indicator (BDHI). The signal is received by the AN/ARA-50 from either the AN/ARC-51A or the AN/ARR-69 system and then the relative bearing to the transmitting UHF station is displayed by the No. 1 needle of the BDHI.

The ADF operation is partially controlled by the C-1457/ARR-40 receiver control panel of the AN/ARR-69 (UHF) auxiliary receiver system (figure FO-2). The AN/ARC-51A (UHF) radio communication system cannot be used in the ADF mode unless the C-1457/ARR-40 control is in the AUX REC/OFF, AUX REC/CMD, or AUX REC/GRD position. To use the AN/ARR-69 auxiliary communication system in the ADF mode, place the C-1457/ARR-40 control in the AUX REC/ADF position.

NOTE

Excessive UHF-ADF bearing errors may result when stores are carried on centerline stations.

OPERATION OF AN/ARA-50 SYSTEM

The AN/ARA-50 ADF equipment is energized when the aircraft electrical system is energized. Tune in a UHF station on either the AN/ARC-51A (UHF) radio communication system or the AN/ARR-69 (UHF) auxiliary receiver system, using the normal communication (blade) antenna. When the station signals are received in the headset, and the station identified, the selected (AN/ARC-51A or AN/ARR-69) system control switch is moved to the ADF position. The received signal is switched from the blade antenna to the ADF antenna. The ADF antenna then rotates to the null point and the relative bearing is displayed by the No. 1 needle of the BDHI.

NOTE

- When the emergency generator is extended, the ARN-52(V), APX-64, ARA-50, ARC-51A, ARR-69, and the compass system are the only navigational aids available to the pilot.
- The ARN-52(V) is inoperative when the landing gear is down.

AN/ASN-19A Navigational Computer Set

Effectivity: Early A-4E aircraft.

The AN/ASN-19A automatic dead reckoning set (figure 1-15) continuously computes and indicates throughout a flight the great circle bearing and range to a target or home base, present latitude and longitude, and the ground track angle. This system consists of a CP-434/ASN-19A computer control (data setting box) on the right console (figure FO-1), an electronic control amplifier in the nose section, and an ID-732/ASN-19A bearing-distance-track indicator on the instrument panel (figure FO-1). The set is operative only when the main generator is running or when external power is applied to the aircraft. The TAS computer, through rotation of a synchro control transformer rotor (which is varied by outside air temperature and pitot/static pressure values), computes TAS information and transmits it to the computer-control which accepts manual inputs of base position, target position, wind, and variation, as well as the automatic input from the TAS transducer and the compass system. These inputs are resolved and integrated to provide great circle bearing, range, and ground track information. Present latitude and longitude may be read in windows on the computer. True great circle bearing and distance to target or base are presented on the indicator by means of a pointer and counter, respectively, and ground track is presented by a moving card.

AXC-666 Air Data Computer

On aircraft reworked per A-4 AFC 464 the air data computer system has been modified by incorporation of an internal switching relay, improved potentiometers in the AVC-666, and new wiring circuitry in the system. The switching relay allows individual power application and automatic control of the AXC-666 when either the AN/ASN-19A, AN/ASN-41 Navigational Computer, or the CP-741/A Weapons Release Computer is turned ON. Observe that the elapsed time indicator on the AXC-666 ADC is operative. The elapsed time indicator should stop when the applicable system is turned OFF. Prior to modification electrical power was ON continuously whenever electrical power was applied to the aircraft.

Modification of the AXC-666 and new circuitry improves reliability of operation and prevents oxidation of potentiometers. Accuracy of weapon system release is improved. (For operational procedures refer to NAVAIR 01-40AV-1T.)

NAVIGATIONAL COMPUTER SET CONTROLS

FUNCTION SWITCH. The function switch selector knob is used to place the set in operation, and has five positions.

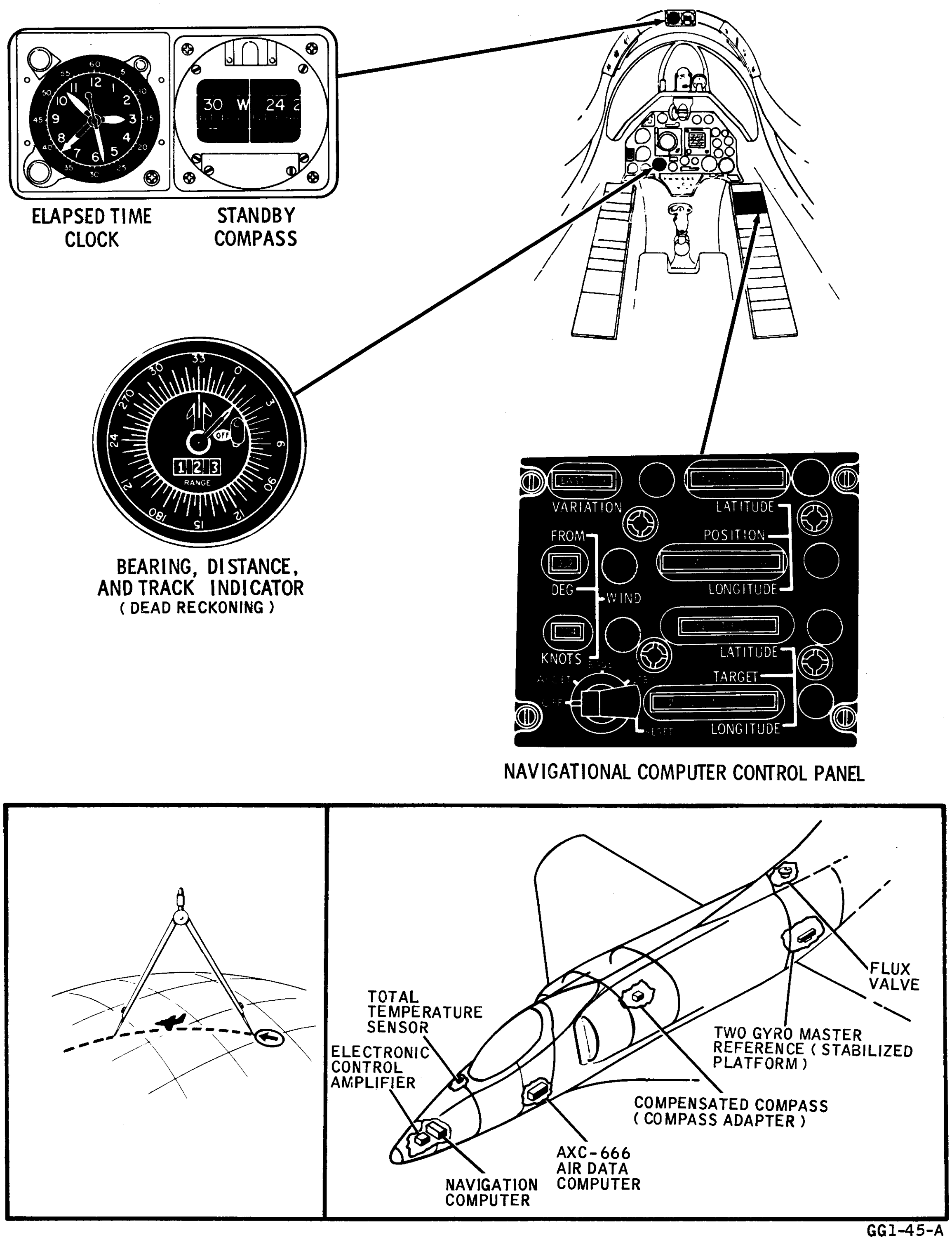


Figure 1-15. AN/ASN-19A Navigation Computer Set

Position	Function
OFF	The set is completely deenergized.
TARGET	Computations are continuously performed so that great circle distance and bearing to the target appear on the indicator.
BASE	Great circle distance and bearing to the base appear on the indicator in place of target data.
STBY	Set is energized and begins warmup.
RESET	Former base position is erased, and a new base position may be established.

LATITUDE AND LONGITUDE INPUT. Four knobs are provided to set position latitude, position longitude, target latitude, and target longitude. Each of these settings is read on an adjacent counter on the computer control box.

The operational range of the computer set is 72 degrees North to 72 degrees South; however, system accuracy decreases moderately at latitudes greater than 50 degrees and rapidly at those greater than 70 degrees.

WIND INPUT. Two knobs are used to set wind direction and velocity on two counters in the computer control box. The computer accepts wind speed from 0 to 200 knots.

NOTE

True wind direction must be set into the computer.

VARIATION INPUT. Magnetic variation up to 180 degrees East or West may be introduced into the computer by means of a single knob adjacent to the variation counter.

OPERATIONAL PROCEDURE

PREFLIGHT. Steps 1 through 7, which do not require electrical power, can be accomplished before the engine is started.

1. Turn function selector knob to RESET. (Knob must be pulled up approximately 1/16 inch.)

2. Set in magnetic variation corresponding to present position. For short flights, use average variation.

3. Set WIND-FROM and WIND-KNOTS counters. (Use true, not magnetic, wind direction.)

4. Set target LATITUDE and LONGITUDE counters. (Knobs must be pushed in.)

CAUTION

Do not rotate latitude knobs through their North/South stops when setting in latitude on counters.

5. Set in point of return (BASE) latitude and longitude on position counters. If point of return and starting point are the same, omit step 6.

6. If point of return and starting point are different, turn selector knob to STBY and set in latitude and longitude of starting point on position counters.

7. Turn selector knob to OFF. (Knob must be pulled up.)

8. After engine is started, switch selector knob to STBY.

9. Select SLAVED compass system operation and SYNC compass (if necessary).

AFTER TAKEOFF. Leave selector knob in STBY until 100 knots TAS is attained. The computer assumes an input of 100 knots minimum, even at lower airspeeds.

1. Turn selector knob to TARGET (or BASE).

2. To fly great circle (shortest) route to target, head aircraft to align bearing needle of indicator with fixed ground track index mark (fiducial mark).

IN-FLIGHT

1. On long flights, correct variation periodically to minimize heading errors.

2. Correct WIND whenever reliable information is available. Incorrect wind settings are the major source of computer error.

NOTE

- A new base position which lies in the flight path can be established without affecting present position computation by turning the selector knob to RESET momentarily, then returning it to TARGET or BASE when present position coordinates coincide with the new base coordinates. Pushing in the counter knobs automatically stops the present position computation. When the knobs are released, computation resumes.

- Course deviations to avoid enemy action, adverse weather conditions, and the like, may be made at any time without affecting the accuracy of computations; however, frequent or large changes of altitude cause the system to indicate arrival at the target slightly ahead of the aircraft.

3. After completing the mission, turn the selector knob to BASE. Read the base range and bearing on the indicator.

NOTE

- At any time during the flight, the target, position, wind, and variation settings may be changed, regardless of the position of the selector knob. Location is continuously shown by the latitude and longitude position windows.

- The base reference is erased whenever the function switch is placed in RESET. The location seen in the position windows at the instant the function switch selector knob is turned from RESET is the new base reference.

- If the aircraft is to be abandoned and its equipment is likely to fall into the hands of an unfriendly nation, the function switch knob should be turned to the RESET position in order to erase base reference.

- The system will not operate on the emergency generator.

FLIGHTS GREATER THAN 1000 MILES

1. Set into the target counters an intermediate fix which lies on the desired flight path and which is less than 1000 miles from the starting position. The intermediate fix may be an arbitrary point along the flight path. If possible, however, employ a recognizable location in order to correct the present position readings if necessary.

2. When the intermediate fix is approached, set into the target counters another intermediate fix which is less than 1000 miles away.

3. When within 1000 miles of the target, set the target coordinates in on the target counters.

4. When returning from the target, use the same procedure as above except turn the selector switch knob to BASE when within 1000 miles of the base position.

NOTE

The use of intermediate fixes does not affect the accuracy of the dead reckoning set but is merely a convenient method for performing long-range flights.

FLIGHTS USING DOGLEGS. The most convenient method of flying doglegs is as follows:

1. Set the target coordinates on the target counters.

2. Before the flight, determine the ground track angle and time required for each leg.

3. Fly each leg using the ground track angle presented by the dead reckoning set indicator and the predetermined time of flight. Since the dead reckoning set continuously computes present position, intermediate legs need not be flown accurately.

4. After entering the last leg, align the bearing pointer with the fiducial mark to obtain the correct path to the target.

If it necessary for the legs to be flown accurately, set in the end point of each leg in turn into the target counters. This procedure will not result in any increase in accuracy over that obtainable from the first method unless the end points are recognizable locations and are used as check points.

AN/ASN-41 Navigation Computer System

Effectivity: All A-4F; late A-4E aircraft

The AN/ASN-41 navigation computer system will supply information to the pilot about his position, windspeed and direction, distance to destination, and bearing and ground track relative to true heading. The system can store two-target destinations without loss of primary data. The navigation system computes and provides outputs of great circle distance and bearing (relative to heading) to either of two

selected targets. A great circle solution is employed for distances greater than 200 miles. A planar solution is employed for distances less than 200 miles. Present position of the aircraft in latitude and longitude coordinates is continuously computed and displayed on the AN/ASN-41 control indicator (figure 1-16). The magnetic heading ground track bearing to the target and distance-to-go is displayed on the BDHI. Three modes of operation are available for system operation: doppler, memory, and air mass mode.

DOPPLER MODE

The doppler mode system receives inputs of groundspeed; drift angle, true airspeed and magnetic heading to compute the groundspeed and airspeed vectors. The comparison of groundspeed and airspeed vectors provides a continuous solution of wind direction and windspeed.

MEMORY MODE

Whenever there is a temporary loss of doppler information, memory mode will automatically actuate the wind memory portion of the AN/ASN-41 computer. The computer retains the last value of wind vector computed and combines the vector with the current airspeed vector to form a new groundspeed.

AIR MASS MODE

When the doppler is completely inoperative, manually inserted wind settings are updated to combine with current airspeed to solve for groundspeed vector. When the APN-153 is inoperative, turn it off and manually set the wind settings on the ASN-41 control indicator panel or compute the drift angle and groundspeed and set them in the APN-153 with the two push-to-set knobs on the APN-153 control panel.

NAVIGATION COMPUTER SET CONTROLS

The controls indicator panel, on the right console, contains the controls and display windows to indicate:

1. PRESENT POSITION – LATITUDE counter (in degrees and minutes) with a mechanical push-to-set knob.

2. PRESENT POSITION – LONGITUDE counter (in degrees and minutes) with a mechanical push-to-set knob.

3. DESTINATION – LATITUDE counter (in degrees and minutes) with a mechanical and electrical set knob.

4. DESTINATION – LONGITUDE counter (in degrees and minutes) with a mechanical and electrical set knob.

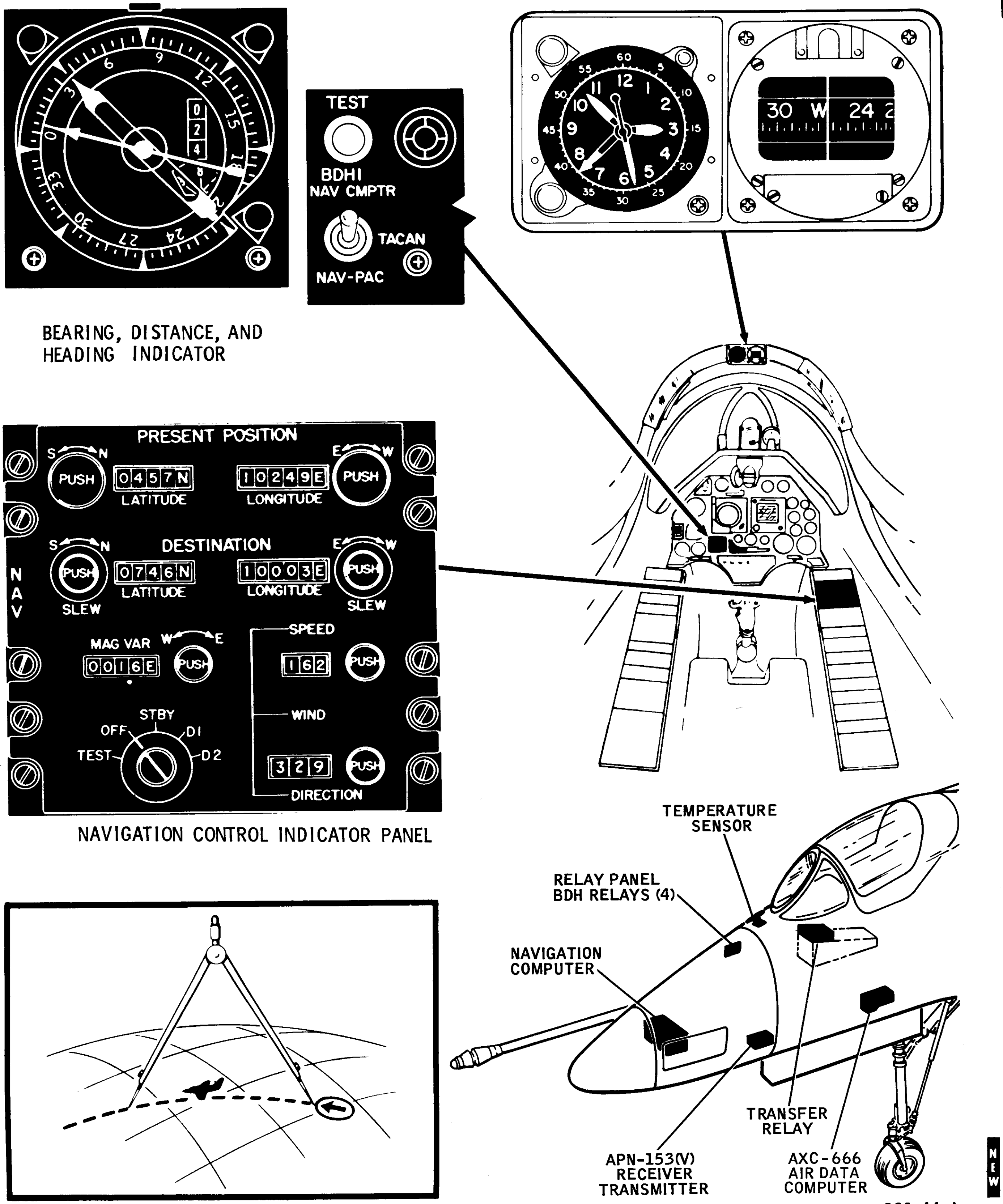
5. MAG VAR (magnetic variation) counter (in degrees and tenths of a degree) with a mechanical set knob.

6. WIND SPEED counter (0 to 300 knots) with a mechanical set knob.

7. WIND DIRECTION (in degrees) with a mechanical set knob.

8. SELECTOR SWITCH – The SELECTOR SWITCH on the control indicator (CONT IND) panel performs the following functions:

Position	Function
1. OFF	The navigation computer system is deenergized. The destination and present position counters can be manually set in preparation for a mission.
2. STBY	Power is applied to the set. Destination one (D1) is displayed on the counters and is also stored in the computer memory circuit. Push-to-set or slew knobs can be used to set-up D1 in the standby position.
3. D1 (Destination)	This position supplies course and distance information for integration of present position counters on the first leg of the mission. This information can be changed at any time using the slew knobs. When in D1 position, only the slew knobs are usable. The push-to-set knobs do not function.
4. D2 (Destination)	This position provides course and distance information for destination two (D2) on the second leg of the mission. Destination two (D2) can be updated by use of the slew knobs only.
5. TEST	This position inserts a presolved problem into the navigation computer whose solution is displayed by the control indicator counter and BDHI.



NEW

Figure 1-16. AN/ASN-41 Navigation Computer System

OPERATIONAL PROCEDURE

PRIOR TO FLIGHT

1. Turn the AN/ASN-41 function selector switch knob to TEST.

2. BDHI switch in NAV CMPTR position. WIND SPEED indicates 223.6±2.5 knots. WIND DIRECTION indicates 091±1.5 degree. LATITUDE PRESENT POSITION shows South integration. LONGITUDE PRESENT POSITION shows East integration. BDHI No. 2 pointer indicates 30±1 degrees right. BDHI No. 1 pointer indication depends on present position and destination data set in.

3. Turn function selector switch knob to STBY.

NOTE

In the STBY position, power is applied to all circuits except the present position integrator.

4. Turn function selector switch knob to D2. Using the electrical slew knobs, set in latitude and longitude destination counters to a destination. If the destination is the starting point, insert present position coordinates.

5. Turn function selector switch knob to STBY and set in D1 checkpoint or target latitude and longitude using the push-to-set or slew knobs.

6. Set in latitude and longitude of present position on present position counters using push-to-set knobs.

7. Set in magnetic variation with mechanical knobs. Variations in degrees and tenths of a degree.

8. Set in wind direction and velocity. Use climb winds.

NOTE

If the AN/APN-153 doppler radar is to be used with AN/ASN-41, step 8 need not be set in. This function will be automatically computed.

9. Leave function selector switch knob in STBY.

10. Set function switch on doppler control to STBY. Allow approximately 5-minute warmup. Turn function switch knob to TEST. If the system is operating properly, the memory light will go off, the ground speed indicator will show 121±5 knots, and the drift angle indicator will show 0±2 degrees.

NOTE

If above doppler test function is not acceptable, insert step 8 to complete the AN/ASN-41 operation.

TAKEOFF

1. If planning to use an airborne starting point, leave AN/ASN-41 function selector switch knob in STBY, and turn selector switch knob to D1 or D2 when passing over that point. If using takeoff point as the starting reference, switch the ASN-41 function selector switch knob to D1 or D2 immediately prior to takeoff roll.

NOTE

Minimum computer-operation airspeed for the ASN-41 is 100 KIAS. A negligible error in computer readout will result until aircraft accelerates to 100 KIAS.

2. Turn AN/APN-153 function switch knob to either LAND or SEA position depending on the terrain over which the aircraft is flying.

3. When doppler operation locks-on (memory light out), the computer will switch to doppler mode and wind information will be automatically computed.

4. When the aircraft is over the starting point, set AN/ASN-41 function selector switch knob to D1. The present position counters will start to integrate toward the target and the wind vector will be computed and displayed.

5. To fly great circle route (shortest route) to target, adjust aircraft heading to align with the No. 1 pointer on BDHI. Ground track (drift angle) is displayed by the No. 2 pointer. The distance counter on the BDHI indicates ground range and slant range to target or destination. To fly to a selected destination (D1 or D2), align the No. 1 pointer over the No. 2 pointer. Only in a no-drift condition will these pointers be aligned at the 12 o'clock position on the BDHI. Example: With the No. 1 pointer at the 12 o'clock position and No. 2 pointer to the right of this position, a right drift would be indicated. This would require a turn to the left to align the pointers. They would then be to the right of the 12 o'clock position when aligned.

6. New targets or checkpoints can be selected while airborne with the ASN-41 navigation computer system operating. Destination 1 selection can be changed by selecting D1 with the function switch and setting the coordinates of the new checkpoint in the

destination window with the slew knobs. D2 coordinates can be changed in the same manner.

The ASN-41 can also be operated using D1 as the first target and D2 as the second target; then turning the function switch knob back to D1 position while enroute to the second target and setting a third target latitude and longitude in the destination window. Turn the function switch knob to D2 position and continue flight to the second target. When over second target, switch again to D1 position for flight to target three.

Another way of using the ASN-41 is to set the point of intended landing in D2 destination window and use D1 position for all checkpoints. Upon arrival at a checkpoint, set latitude and longitude of next checkpoint in destination windows utilizing the slew knobs with the function switch knob left in D1 position at all times until ready to proceed to point of intended landing when D2 is selected. This method provides instantaneous bingo information from any point on the route by merely shifting to the D2 position.

In order to precisely set preset position upon completion of mission over target (D1), make a long enough turn to approach the entry point of the second leg with a minimum of 2 minutes of level flight and the two pointers on BDHI aligned. Make any changes necessary to make present position coordinates the same as the longitude and latitude on target 1. At crossover of the entry to second leg, rotate function selector switch knob to D2, keeping the pointers of BDHI aligned and fly to target.

IN-FLIGHT. Monitor the navigation system and, if necessary, update the following situations:

1. If the doppler radar is off for a considerable time, the wind data can be manually updated, using the predicted wind information from the flight plan. To update the wind data in this case, it is necessary to turn the AN/APN-153 to OFF or STBY and update the wind data on the AN/ASN-41. Otherwise, it is necessary to compute the drift angle and groundspeed and insert them in the AN/APN-153 with the push-to-set switches on the AN/APN-153 control box to change wind data in the AN/ASN-41.

AN/APN-153(V) Radar Navigation Set (Doppler)

Effectivity: All A-4F; late A-4E aircraft

The AN/APN-153(V) (figure 1-17) is a miniaturized radar navigation set that uses the doppler principle for continuous measurement of groundspeed and drift angle. The radar set transmits rf energy to the ground and measures the shift in frequency of the returned energy to determine aircraft groundspeed, and drift angle. The AN/APN-153(V) doppler radar set is contained completely within the aircraft and does not depend on ground aids for navigation purposes. The radar set automatically acquires doppler information and computes groundspeed and drift angle within about 1 minute after it is turned ON. The AN/APN-153(V) doppler radar set operated in conjunction with the AN/ASN-41 computer provides navigation to and from preselected targets.

SYSTEM OPERATION

The AN/APN-153(V) doppler radar navigation set controls and indicators are on the C-4418/APN-153(V) control indicator panel, labeled NAV and located on the right console (figure 1-17). To operate the AN/APN-153(V) doppler radar set, the selector switch knob must be turned ON to either the LAND or SEA position depending on the terrain over which the aircraft will be flying. In the SEA position, the scale factor calibration network is altered to compensate for the apparent increase in antenna looking angle when the aircraft is flying over water, thus providing proper groundspeed calibration. Circuits within the frequency tracker automatically sweep over the operating groundspeed range, seeking a usable return signal. When the reflected rf energy is of sufficient power to permit measurement of groundspeed and drift angle, then the set is switched to the normal mode of operation. Until this change takes place, the set is in the memory mode and the MEMORY light on the C-4418 control indicator panel is on. While the doppler radar set is in the memory mode, the groundspeed and drift angle readings on the C-4418 control indicator panel are the values computed when the doppler radar set was in the normal mode. Drift angle (DA) and groundspeed (GS) push-to-turn control knobs are provided to enable the pilot to change groundspeed and drift angle when the doppler radar set is in the memory mode. If a malfunction should occur in the doppler radar set while it is connected to the AN/ASN-41 computer, the pilot can use the DA and GS knobs to insert approximate drift angle and groundspeed value and enable the computer to continue operating. In the LAND position, the preceding conditions can also be handled.

The set may go into the memory mode under any of the following conditions:

1. Selector switch knob is at STBY, transmitter will be off.

2. The period after the system has been turned on and before a signal has been acquired. This period will be about 1 minute.

3. During operation over smooth glassy seas.

4. During operation over extremely hilly terrain, where coherence may be lost despite broad antenna beams.

5. During periods when the aircraft is maneuvering beyond the antenna's limits of operation.

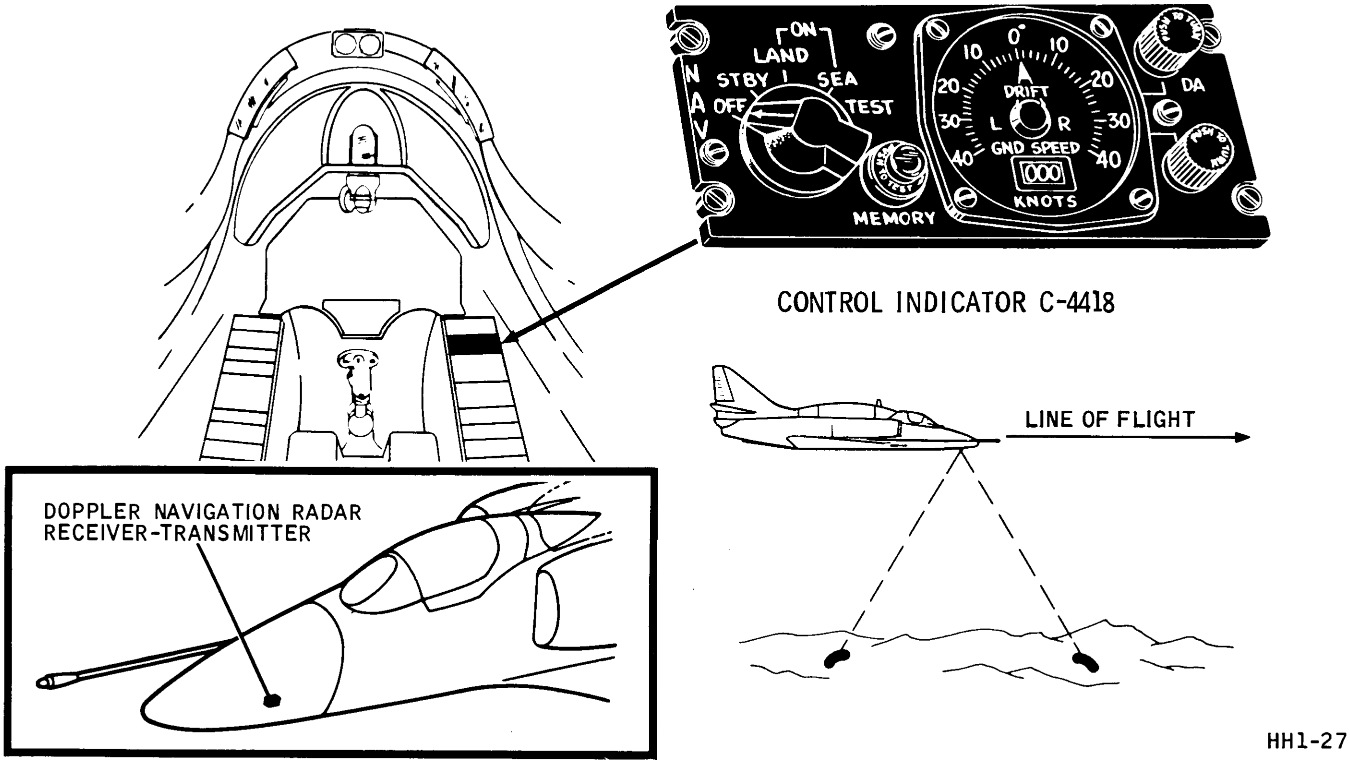


Figure 1-17. AN/APN-153(V) Radar Navigation Set (Doppler)

In the STBY position, all power except the modulator power required to drive the magnetron is applied to the AN/APN-153(V) doppler radar set. This position is used when observing radar silence or when maintenance personnel wish to check the system. When the selector switch is on STBY, the system goes into memory mode and the amber MEMORY light comes on.

PRIOR TO FLIGHT

1. Turn selector switch knob to the TEST position. After 5 minutes warmup time the memory light should go off, the groundspeed dial should read 121±5 knots, and the drift angle dial should read 0±2 degrees.

2. Turn selector switch knob to STBY.

PRIOR TO TAKEOFF. Turn selector switch knob to the ON-LAND or ON-SEA position, depending upon the terrain to be flown over.

AFTER TAKEOFF

1. Within approximately 30 seconds after the aircraft has reached 150 knots and an altitude of 40 feet, the memory light should go off.

2. After cruise altitude is attained, groundspeed and drift angle should be observed to read within ±50 knots and ±10 degrees respectively for the known condition of flight.

NOTE

It may be necessary to use the push-to-set knob and set the doppler to 150 knots after test and prior to takeoff.

3. Bank and turns are limited to 30-degree roll right or left and/or to type of terrain being flown over. If the above limitations are exceeded, the memory light will come on, indicating loss of tracking signal.

4. Climbing and descending maneuvers should be closely controlled. High-angle climbs and descents should be limited to approximately 25-degree pitch attitude, since this pitch angle is near the operating limits. The memory light may come on for periods of time, not to exceed 3 seconds.

5. At combat ceiling and at lowest mission altitude (not below 40 feet), the memory light should remain off, indicating doppler signal lock-on and tracking.

AN/APG-53A Radar System

Effectivity: All A-4E aircraft

The AN/APG-53A radar system (figure 1-18) provides the pilot with search or mapping capabilities for navigational purposes, two modes of terrain clearance for obstacle avoidance in either the azimuth or elevation plane, and air-to-ground slant range for weapons delivery. Automatic fire control is not provided.

Operating controls are provided on the radar control panel located on the right-hand console, on a small radar switch panel installed near the center of the bottom edge of the instrument panel, and around the perimeter of the azimuth-elevation-range indicator (scope) mounted in the instrument panel.

NOTE

On A-4E aircraft reworked per A-4 AFC 256, the radar control panel is located on the right-hand console. On A-4E aircraft reworked per A-4 AFC 387, the radar control panel is located on the left-hand console (figures 1-18, FO-1, and FO-2).

Four modes of operation are available for pilot selection: standby, search, terrain clearance, and slant range. In search mode, the B scope presentation is utilized; in terrain clearance mode, B scope presentation is used for PLAN and E scope presentation is used for PROFILE, while slant range mode is presented as a vertical sweep range bar.

NOTE

When using terrain clearance mode, both PROFILE and PLAN must be used for obstacle avoidance.

RADAR COMPONENTS

Figure 1-18 illustrates the components of the radar set. The pilot actuated controls, azimuth-elevation-range indicator (scope) and lights are shown at the top of the figure. Remotely located components are shown in the lower portion. The radar set operates on a 115-vac, 3-phase, 400-cps power supplied by the aircraft generator.

NOTE

The radar system will not operate on emergency generator.

RADAR CONTROLS

RADAR CONTROL PANEL. The radar control panel is located on the right-hand console on all aircraft reworked per A-4 AFC 256 and on the left-hand console on all aircraft reworked per A-4 AFC 387. The control panel contains a rotary antenna elevation control knob, a mode selector switch knob, an angle-of-attack compensation toggle switch, and a volume control knob for the aural-warning tone.

The antenna elevation control knob provides the pilot with manual control of the antenna elevation angle. The normal elevation limits of the antenna are plus 10 degrees and minus 15 degrees, with respect to the elevation zero position. In the terrain clearance PROFILE mode of operation, the antenna tilt control knob has no effect since the programing circuits in the altitude computer control the antenna and cause it to sweep between the lower and upper position limits.

A rotary mode selector switch knob provides application or removal of primary power and selection of the type of operation. In the standby position, the selector switch causes energizing of all primary power relays and initiates the modulator time delay (warmup) period. When turned to one of the operating positions, the selector switch sets up the system for performing the required functions in the mode selected and also allows energizing of the modulator if the normal 3-minute time delay period has elapsed.

A guarded angle-of-attack switch of the two-position toggle type enables the pilot to remove the angle-of-attack compensation if the airflow sensor becomes inoperative. When the switch is in the OFF position, the zero reference line of antenna elevation is the armament datum line rather than the flight path.

RANGE SELECTOR SWITCH. The range selector switch is located in the center of the instrument panel (figure 1-19). The switch has two positions labeled LONG and SHORT. Ranges provided are as follows:

Mode	Short	Long
SRCH	20 miles	40 miles
T/C	10 miles	20 miles
A/G	15,000 yards	15,000 yards

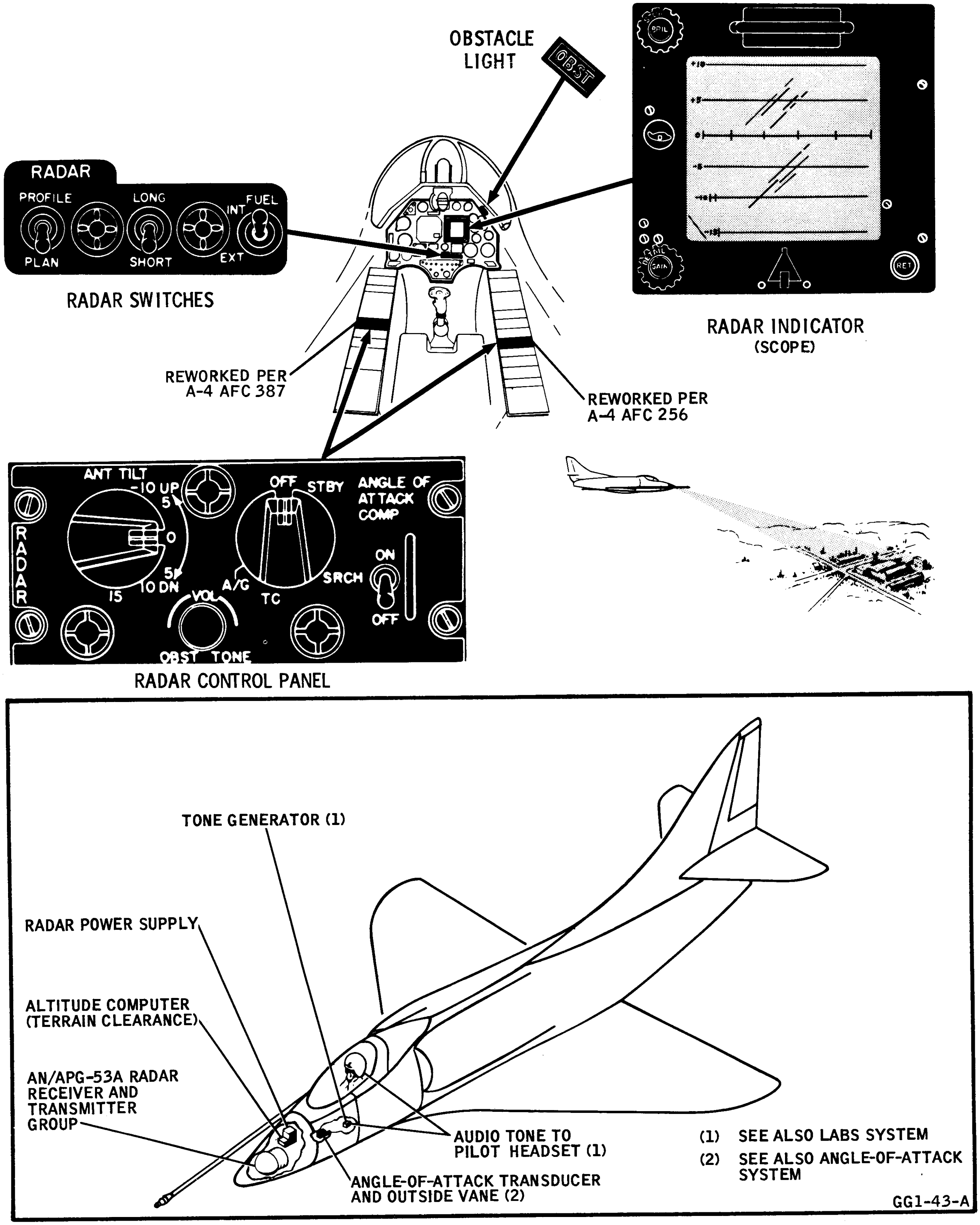


Figure 1-18. AN/APG-53A Radar System (A-4E)

4. Climbing and descending maneuvers should be closely controlled. High-angle climbs and descents should be limited to approximately 25-degree pitch attitude, since this pitch angle is near the operating limits. The memory light may come on for periods of time, not to exceed 3 seconds.

5. At combat ceiling and at lowest mission altitude (not below 40 feet) the memory light should remain off, indicating doppler signal lock-on and tracking.

AN/APG-53A Radar System

Effectivity: All A-4E aircraft

The AN/APG-53A radar system (figure 1-18) provides the pilot with search or mapping capabilities for navigational purposes, two modes of terrain clearance for obstacle avoidance in either the azimuth or elevation plane, and air-to-ground slant range for weapons delivery. Automatic fire control is not provided.

Operating controls are provided on the radar control panel located on the right-hand console, on a small radar switch panel installed near the center of the bottom edge of the instrument panel, and around the perimeter of the azimuth-elevation-range indicator (scope) mounted in the instrument panel.

NOTE

On A-4E aircraft not reworked per A-4 AFC 256, the radar control panel is located on the left-hand console.

Four modes of operation are available for pilot selection; standby, search, terrain clearance, and slant range. In search mode the B scope presentation is utilized, in terrain clearance mode B scope presentation is used for PLAN and E scope presentation is used for PROFILE, while slant range mode is presented as a vertical sweep range bar.

NOTE

When using terrain clearance mode, both PROFILE and PLAN must be used for obstacle avoidance.

RADAR COMPONENTS

Figure 1-18 illustrates the components of the radar set. The pilot actuated controls, azimuth-elevation-range indicator (scope) and lights are shown at the top of the figure. Remotely located components are shown in the lower portion. The radar set operates on a 115-vac, 3-phase, 400-cps power supplied by the aircraft generator.

NOTE

The radar system will not operate on emergency generator.

RADAR CONTROLS

RADAR CONTROL PANEL. The radar control panel is located on the left-hand console (All aircraft not reworked per A-4 AFC 256) or the right-hand console (All aircraft reworked per A-4 AFC 256). The control panel contains a rotary antenna elevation control knob, a mode selector switch knob, an angle-of-attack compensation toggle switch, and a volume control knob for the aural-warning tone.

The antenna elevation control knob provides the pilot with manual control of the antenna elevation angle. The normal elevation limits of the antenna are plus 10 degrees and minus 15 degrees, with respect to the elevation zero position. In the terrain clearance PROFILE mode of operation, the antenna tilt control knob has no effect since the programing circuits in the altitude computer control the antenna and cause it to sweep between the lower and upper position limits.

A rotary mode selector switch knob provides application or removal of primary power and selection of the type of operation. In the standby position, the selector switch causes energizing of all primary power relays and initiates the modulator time delay (warmup) period. When turned to one of the operating positions, the selector switch sets up the system for performing the required functions in the mode selected and also allows energizing of the modulator if the normal 3-minute time delay period has elapsed.

A guarded angle-of-attack switch of the two-position toggle type enables the pilot to remove the angle-of-attack compensation if the airflow sensor becomes inoperative. When the switch is in the OFF position, the zero reference line of antenna elevation is the armament datum line rather than the flight path.

RANGE SELECTOR SWITCH. The range selector switch is located in the center of the instrument panel (figure 1-19). The switch has two positions labeled LONG and SHORT. Ranges provided are as follows:

Mode	Short	Long
SRCH	20 miles	40 miles
T/C	10 miles	20 miles
A/G	15,000 yards	15,000 yards

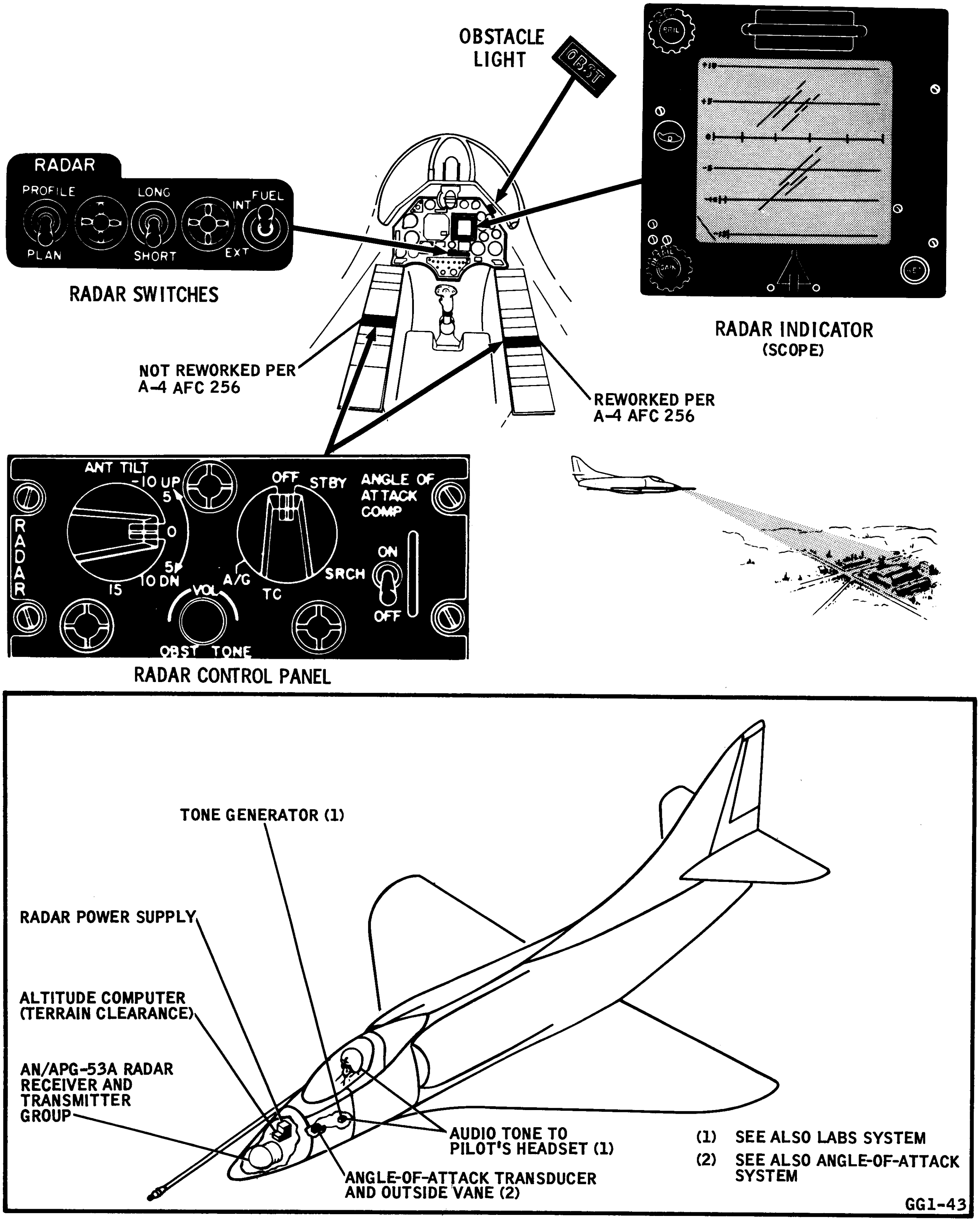


Figure 1-18. AN/APG-53A Radar System (A-4E)

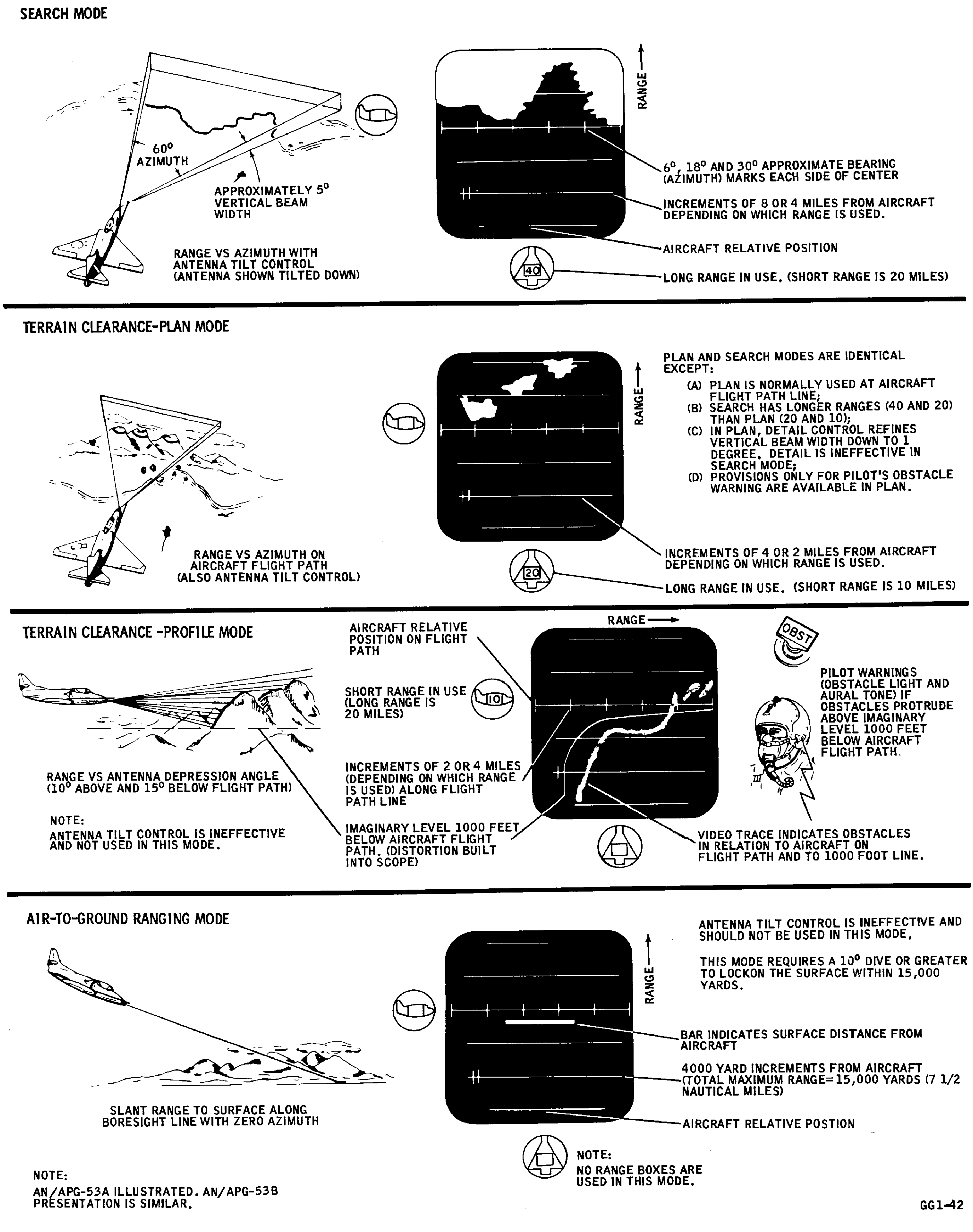


Figure 1-19. Radar Scope Presentations

TERRAIN CLEARANCE MODE SELECTOR SWITCH. The switch is located in the center of the instrument panel adjacent to the range selector switch and has two positions marked PLAN and PROFILE. The switch is functional when the mode selector switch (on the left console) is at T/C, and is used to select an E-scope presentation (profile mode) (figure 1-20) or a B-scope presentation (plan mode) (figure 1-20).

OBSTACLE LIGHT. A yellow caution light labeled OBST is located beneath the right side of the glareshield. This light functions only when in terrain clearance-profile mode operation. The OBST light flashes whenever a target projects above the electronically produced line displayed on the scope which represents an imaginary plane 1000 feet below the antenna zero-degree reference line. (Provisions are available for wiring the OBST light in the plan mode.)

AURAL-WARNING TONE. In terrain clearance PROFILE mode operation, an aural-warning tone is heard in the pilot's headset at the same time that the obstacle light comes on. A volume control for the aural-warning tone is located on the radar control panel on the left console. (Provisions are available for wiring the aural tone in the plan mode.)

RADAR INDICATOR (SCOPE)

Located in the center area of the instrument panel is the radar indicator, designed to display targets with a brilliance sufficient to permit viewing without the use of a hood. In addition to the iatron tube, the indicator contains the necessary sweep circuits and the high-voltage power supply. Flag-type indicators, one on the left side in a horizontal aircraft and the other at the bottom in a plan-view aircraft, show the range scale being used. (See figure 1-19.)

Front panel controls permit adjustment of brilliance, storage, gain, and detail. Brilliance and storage controls are on concentric shafts, and regulate the brightness and storage time (how long the picture lasts) of the indicator display. Gain and detail controls are also concentric. The gain control varies the amplitude of the signals applied to the indicator, and therefore, the sensitivity of the radar. It is the strength or "sum" of the picture signal. The normal setting of the gain control is approximately three-quarters of its clockwise travel. The detail control has the effect of varying the effective vertical beam width in the terrain clearance modes. It governs the sharpness or "difference" of the picture. This control is used in conjunction with the gain control to obtain 1 degree resolution of vertical beam width in the profile mode, and is determined by reference to the horizontal elevation markings on the scope reticle. The reticle knob controls the illumination of range-elevation-azimuth reference lines on the scope reticle for operation of radar in night lighting conditions.

NOTE

- Gain and detail controls have no effect in the air-to-ground mode.
- Detail control has no effect in the SRCH mode.
- Dimming of radar scope is completely independent of interior lights controls.

A red filter plate to cover the face of the scope is a Douglas addition to the AN/APG-53A Radar Set. The filter is a red acrylic plate permanently secured to a spring-loaded hinge. It is used in the down position for night flying, to change the yellow-green target display to a red display to coincide with the red instrument lighting. During daytime flying, the plate is manually raised away from the face of the indicator (scope) so that a normal (yellow-green) display is seen.

OPERATING MODES

SEARCH MODE. The search mode presentation displays range versus azimuth. Either 0- to 20-mile range or 0- to 40-mile range in nautical miles may be selected. The range in use is shown by a flag-type marker in the plan-view aircraft at the bottom of the scope. The indicator face is divided by horizontal lines, each representing one-fifth of the total range.

With the range switch in the LONG position, the bottom (minus 15 degrees) line is zero range and the top (plus 10 degrees) line is 40 miles. This gives a calibration line every 8 miles.

With the switch at the SHORT position, each division represents 4 miles.

In SRCH, the radar antenna is programmed to sweep 60 degrees in azimuth using a 5 degree cone of radiation at the elevation angle (antenna tilt) selected by the pilot. Vertical marks on the zero elevation line of the reticle show the approximate bearing to any point on the display. The marks represent 6, 18, and 30 degrees each side of center. The antenna elevation is set by the pilot and may be varied from 10 degrees above to 15 degrees below the flight path (angle-of-attack switch ON).

Turning the antenna tilt control moves the radar antenna up or down. This function is an aid to search and ground mapping procedures. In the search mode, the antenna will remain in the position indicated by

the antenna tilt control. A friction device prevents the tilt control from returning to zero until the pilot manually repositions it or the mode selector on the control panel is moved from SRCH to the T/C position.

The search mode display is a B-scope presentation (range vs azimuth) of the terrain ahead of the aircraft.

Targets will appear on the scope as bright yellow-green spots. Surfaces which reflect little energy back to the radar, such as smooth water, appear on the scope as dark or unlighted areas. The result is a maplike display which is linear in the range coordinate but distorted in azimuth by a factor which is inversely proportional to range. This distortion is due to presentation of the conical radiation pattern as a rectangular display on the scope (see figure 1-20). Coast lines, islands, lakes, wide rivers, and highly reflective areas such as cities or factory complexes may be used to aid navigation when operating above an overcast or in reduced visibility, and at an altitude that ensures safe terrain clearance. The 40-mile range provides for long-range identification of coastlines. The 20-mile range permits detailed examination of closer objects. Range is attenuated as altitude is reduced so that at 1000 feet above level terrain, target return is reduced to about 18 miles except for specific targets at greater range with significant vertical development.

Brilliance and storage, can be changed at any time to get the best picture, depending upon varying cockpit lighting conditions. Normally, the gain setting should be established by "snowing" the scope, then reducing the setting to a point where only a trace of snow remains. As tilt control is changed, usually gain control will require readjustment to create the desired scope sensitivity for the range (tilt) selected. As the antenna is depressed, the gain must be reduced (counterclockwise). If only the highly reflective areas are of interest, the gain setting is reduced until only such areas are displayed.

TERRAIN CLEARANCE-PLAN MODE. With the profile-plan switch in the PLAN position, the rotary mode selector switch in the T/C position, and the angle-of-attack switch ON, the indicator (scope) provides a B-scope (range-versus-azimuth) presentation of obstacles in the projected flight path of the aircraft.

The terrain clearance PLAN display is provided to enable the pilot to maneuver around obstacles rather than over them.

Azimuth scan is 60 degrees using a beam width of 5 degrees and a vertical beam width effectively reduced to 1 degree by means of the detail control on the scope.

The vertical width of the beam is determined by the setting of the detail knob on the indicator. With the knob fully counterclockwise, beam width is approximately 5 degrees; fully clockwise, beam width approximates 1/2 of 1 degree. The scope will display only those obstacles that are within the beam. If the antenna tilt control is at zero degrees and the angle-of-attack switch is in ON, the objects shown will be in a plane that contains the projected flight path and is parallel to the lateral axis of the aircraft. With the angle-of-attack switch OFF, the objects will be in the plane of the armament datum line. Only radar return from the near slope of mountains is received so the presentation is usually patchy as shown in figure 1-20.

The pilot may examine terrain above or below the flight path (or ADL) by manually adjusting the tilt control to the desired setting (from plus 10 degrees to minus 15 degrees). However, the tilt control knob is spring loaded in the T/C modes and will return to zero when released.

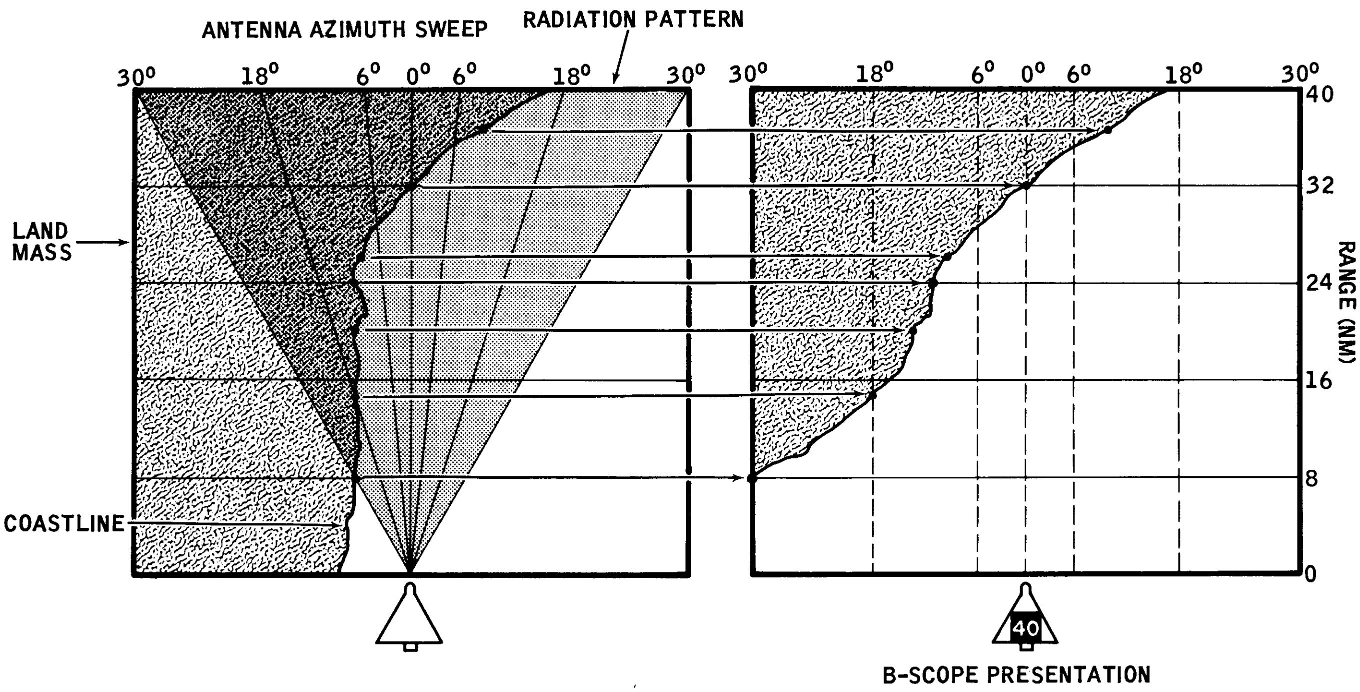
Available for selection are ranges of 0 to 20 or 0 to 10 nautical miles (LONG or SHORT).

The range in use is indicated by a flag-type marker in the plan-view aircraft at the bottom of the scope as in SRCH mode. The horizontal lines on the indicator face each represent one-fifth of the total range. With the range switch at LONG, each calibration line represents 4 miles; in the SHORT position, 2 miles. Azimuth markings are identical to search mode; 6, 18, and 30 degrees to the left or right of the aircraft heading.

TERRAIN CLEARANCE – PROFILE MODE. With the presentation switch at PROFILE and the rotary mode selector switch at T/C, the indicator (scope) provides an E-scope (range versus antenna depression angle) display of the terrain profile ahead of the aircraft. The radar beam automatically locks in azimuth and sweeps in elevation from plus 10 degrees to minus 15 degrees using a beam width of 5 degrees and a vertical beam width effectively reduced to 1 degree by means of the detail control on the scope.

The elevation zero is normally referenced to the flight line by including an angle-of-attack correction in the servo loop. This provides for an extended antenna sweep up to a maximum of plus 11 degrees to minus 19 degrees from the armament datum line (antenna sweep limits). In the event the angle-of-attack sensor vane becomes damaged, frozen, or inoperative, the angle-of-attack switch is provided to lock the zero reference line with the armament datum line. The antenna tilt control does not function in this mode.

The LONG-SHORT range switch provides either 20- or 10-mile ranges for sufficient detail under various conditions. Vertical marks on the horizontal



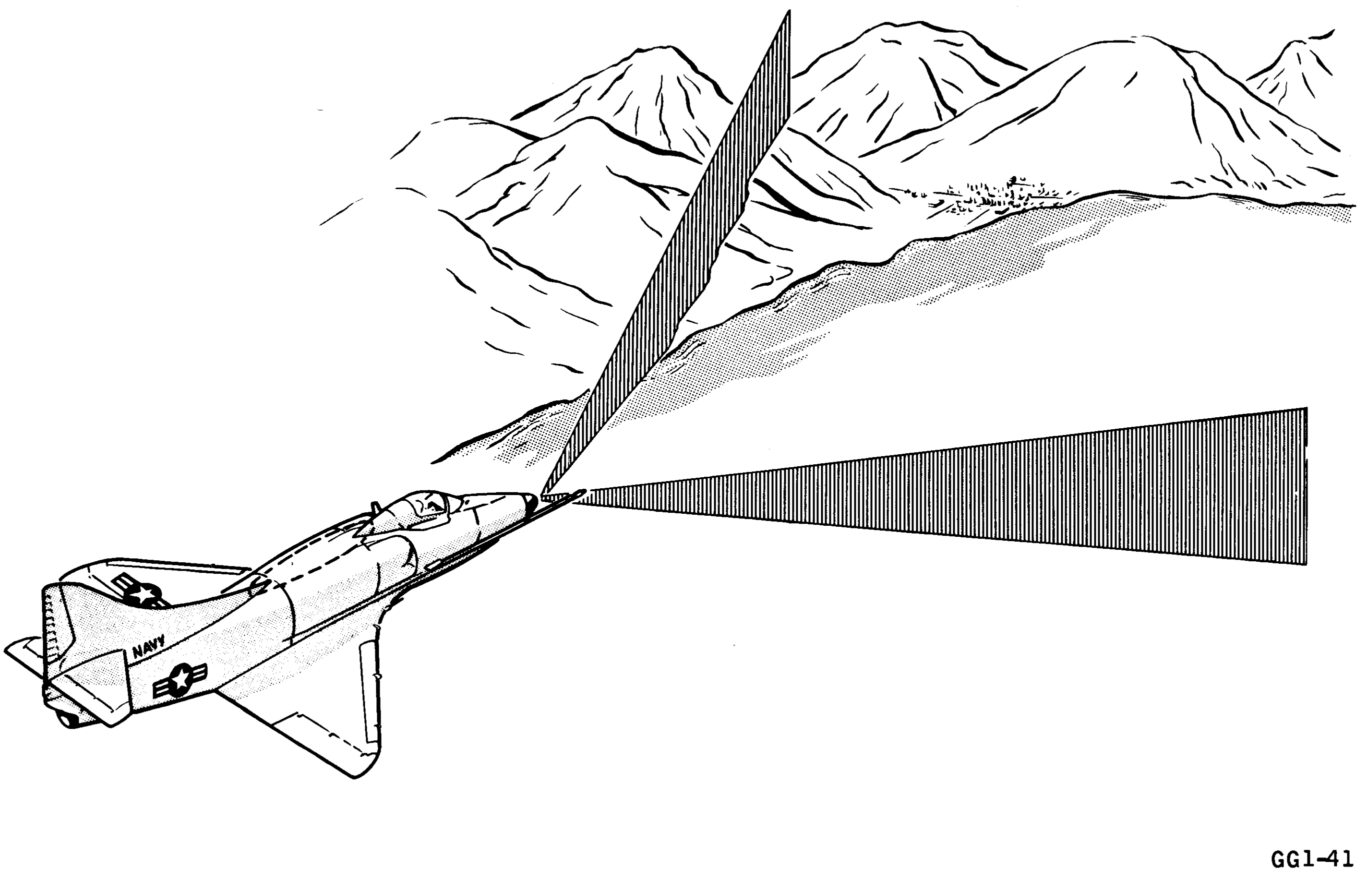
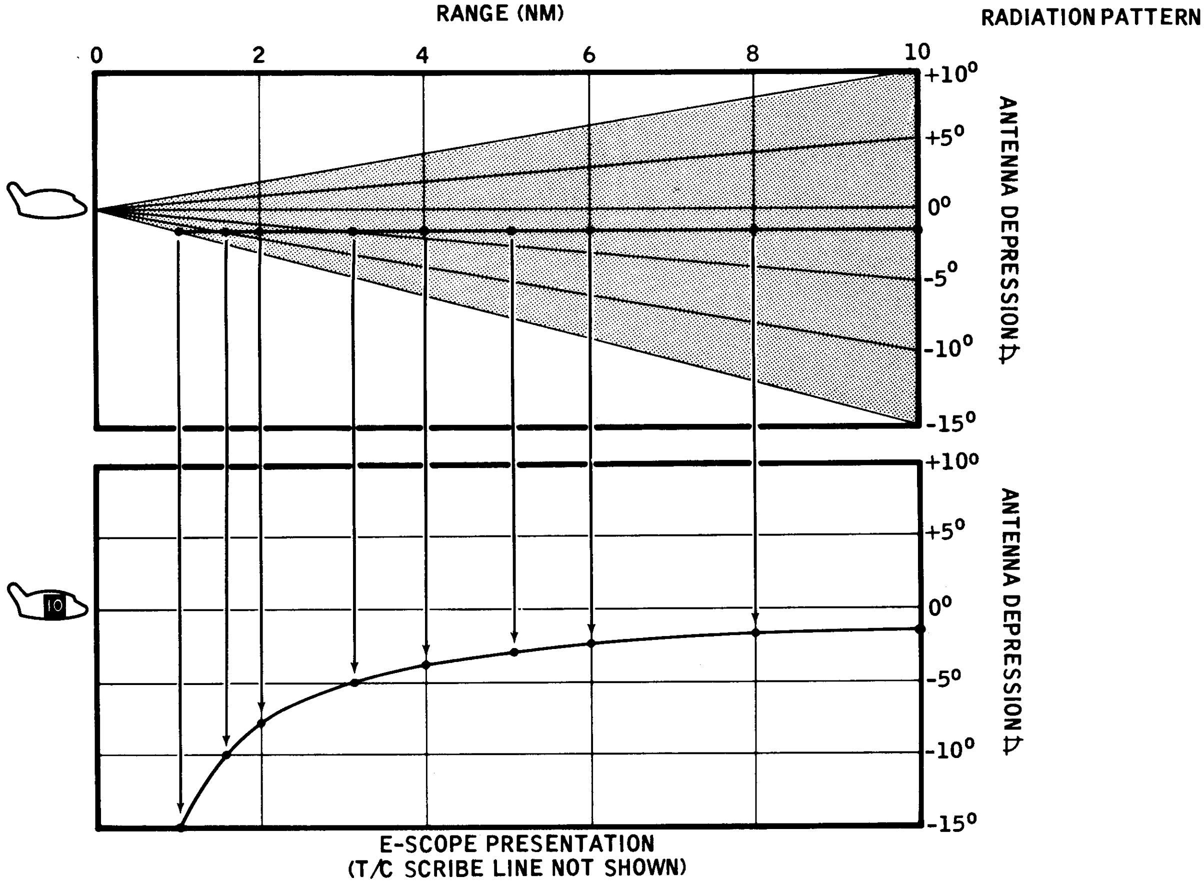


Figure 1-20. Radar Scope Distortion (Sheet 1)



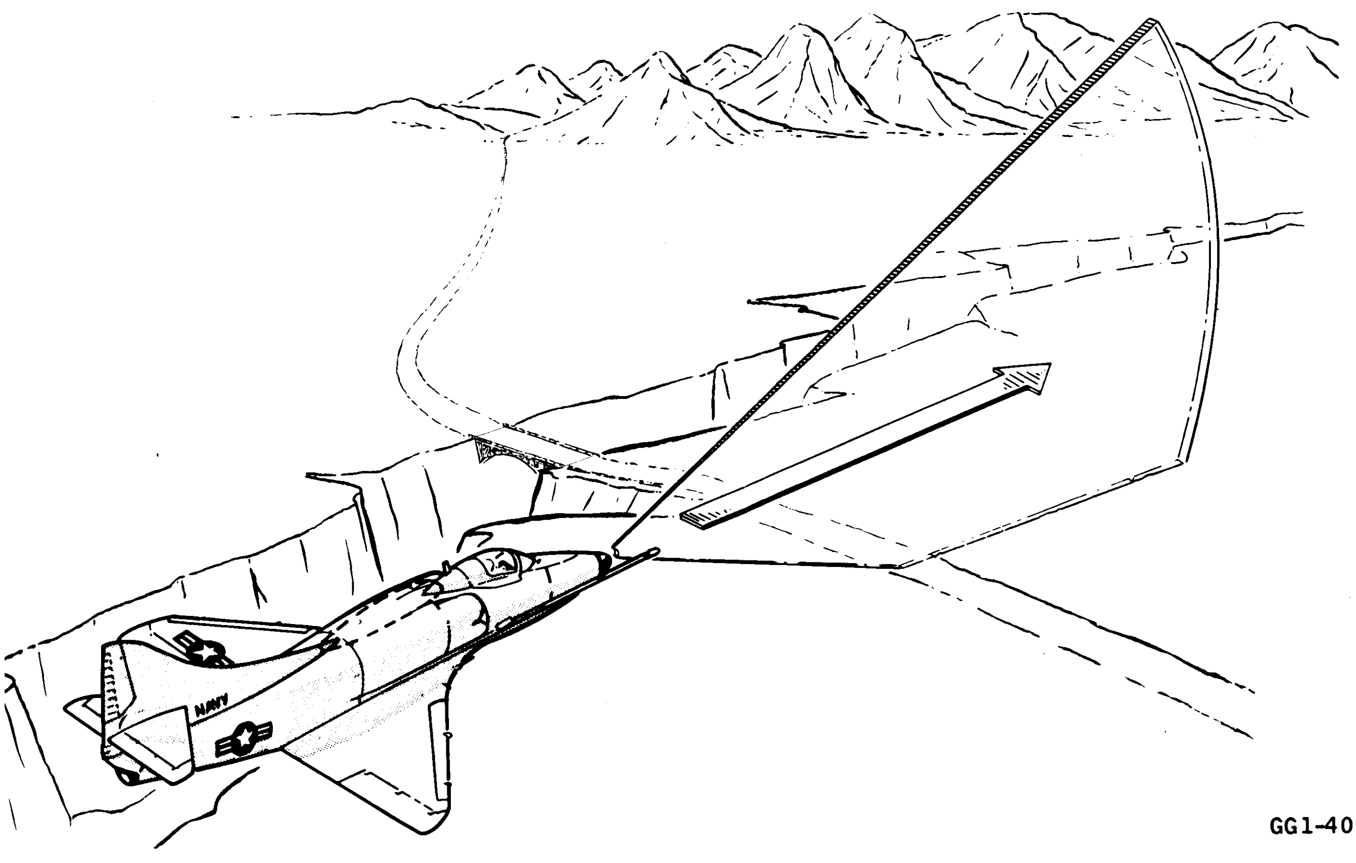


Figure 1-20. Radar Scope Distortion (Sheet 2)

zero-degree elevation line divide the display into 2- or 4-mile segments according to the range in use. A flag-type marker in the aircraft silhouette at the left of the scope shows which range is in use.

A solid line representing an imaginary plane 1000 feet below the antenna zero-degree elevation line is electronically displayed on the indicator as an aid to low-level navigation. This is the terrain clearance scribe line (see figure 1-20) and is synchronized with the elevation sweep. The zero-degree elevation line of the indicator reticle represents the instantaneous forward projection of the aircraft flight or armament datum line depending on the position of the angle-of-attack switch. Since the vertical calibration is in degrees of anntenna depression angle rather than in feet of altitude, the resulting expansion of the conical radiation pattern into a rectangular display causes the 1000-foot marker and radar target return to curve downward at the low range end of the indicator. (See figure 1-20.)

An irregular line display is the radar return. Assuming level terrain and by flying so that the radar return presentation is parallel to the 1000-foot marker, it is possible to fly at a constant altitude above level terrain.

The PROFILE function also incorporates both visual and aural warning to the pilot when obstacles protrude above a horizontal plane positioned 1000-feet below and parallel to the antenna zero-degree reference plane.

The obstacle alarm consists of both the obstacle light and the pilot's headset signal, warning the pilot that a potential hazard exists.

The alarm is controlled by the same circuits that control the 1000-foot terrain clearance scribe line and warns if any obstacle appears above it. A rough indication of the range to the target is provided by the percentage of time that the alarm is actuated. Targets near maximum range will give short blinks and as the target comes closer, the light will remain on for longer periods.

NOTE

By comparing the presentations in the PLAN and the PROFILE modes, the pilot can quickly decide whether to change elevation or bearing to avoid obstacles.

WARNING

- When flying 1000 feet terrain clearance at normal low-level airspeeds, crosswind component of 9 knots or more can cause a drift rate that would preclude displaying obstacles in the ground track of the aircraft in PROFILE mode. To prevent inadvertent collision with an obstacle, it is necessary to shift to PLAN mode to scan the 60-degree forward sector at intervals of 1 minute or less unless flying over known level terrain.
- Whenever possible, boresight should be checked at 1000 feet above terrain after each radar mission takeoff.

The PROFILE display also provides an aid to letdown under conditions of reduced visibility. The letdown is accomplished simply by descending at the desired schedule until the radar return intersects the 1000-foot terrain clearance scribe line at a range of 6 miles when operating on LONG range. The dive angle is then continuously readjusted to maintain the intersection of radar return and T/C scribe line at 6 miles. This results in a gradual reduction in dive angle (and rate of descent) until in straight and level flight 1000 feet above the terrain.

AIR-TO-GROUND MODE

NOTE

In aircraft equipped with CP-741/A (Weapons Release Computer), the air-to-ground (A/G) mode can be used for slant range input to the computer.

With the mode selector switch in the A/G position, the indicator (scope) shows the distance to the ground dead ahead. The antenna is automatically fixed in the azimuth zero position and is parallel to the armament datum line in the elevation coordinate. When the antenna boresight line and the sight line are made parallel (zero mil lead), the range indication will show the distance to the point on the ground at which the sight is aimed. The angle between the ground and the antenna boresight line should be at least 10 degrees to provide adequate radar return for ranging lock-on.

If the distance to the ground exceeds the radar lock-on range, the horizontal line will search from the top of the scope to the bottom. When ground lock-on occurs the line will stop cycling and, as the slant range decreases, the bar will move downward. The solid horizontal bar gives the pilot the approximate slant range in yards. The total maximum range in

the A/G mode is 15,000 yards (approximately 7 1/2 nautical miles. The aircraft relative position is at the bottom line on the scope (minus 15 degree elevation line). After range lock-on of the horizontal bar, slant range can be read by reference to the horizontal lines etched on the reticle each of which represents a range increment of 4000 yards.

GROUND PROCEDURE

PREFLIGHT. Position controls as follows:

1. Radar control panel mode selector switch . . . . . . OFF

   Antenna tilt control . . . . zero degrees

   Angle-of-attack switch . . . . . OFF

2. Radar indicator brilliance knob . . . . full-clockwise

   Gain knob . . . . full counterclockwise

   Storage knob . . . . full-clockwise

   Detail knob . . . . full counterclockwise

   Reticle knob . . . . full counterclockwise

3. Radar switch panel range switch . . . . LONG

   T/C PLAN-PROFILE switch . PROFILE

BEFORE TAKEOFF. Test the scope presentations as follows:

1. Mode selector switch . . . . . . STBY (Allow 3 minutes for equipment warmup.)

2. Mode selector switch . . . . . . SRCH

3. Antenna tilt switch . . . . minus 6 degrees

4. Turn gain control knob clockwise until targets appear.

5. Position range switch at SHORT. Presentation should double in size. Confirm that flag indicates 20 miles.

6. Position mode selector switch at T/C. Confirm that flag indicates 10 miles. Antenna tilt control should zero. Turn gain knob clockwise until targets appear to be 5 degrees in vertical dimension. Turn detail knob clockwise until targets are reduced to 1 degree in vertical dimension. Tails should be disregarded in any 1 degree analysis. These may be observed on late model radar sets as shown in figure 1-21.

7. Observe terrain clearance line on scope. Position range selector switch to LONG. Confirm that terrain clearance line moves to the left and slightly up.

8. Position mode selector switch to A/G and confirm that horizontal line on scope sweeps from top to near bottom.

9. Position the mode selector switch to OFF.

IN-FLIGHT PROCEDURE

IN-FLIGHT TEST. A brief operational check during the first part of each tactical flight is recommended.

SEARCH MODE. Make sure that ac power is available (note that the all-attitude indicator flag is not visible after a 90-second warmup).

1. Mode selector switch . . . . STBY

NOTE

A 3-minute warmup procedure is required.

2. Angle-of-attack switch . . . . . . ON

3. Antenna tilt control . . . . desired setting

4. LONG-SHORT range switch . . . desired range

5. Mode selector switch . . . . SRCH

6. Brilliance, storage, and gain knobs . . . . desired picture

NOTE

- The PLAN-PROFILE switch is not functional in SRCH mode.
- There is no obstacle alarm in the SRCH mode.

TERRAIN CLEARANCE-PROFILE MODE. After observing the radar set operating properly in search mode, or after performing step 1 of the search mode procedure, perform the following steps:

1. Angle-of-attack switch . . . . . . OFF

2. Mode selector switch . . . . T/C

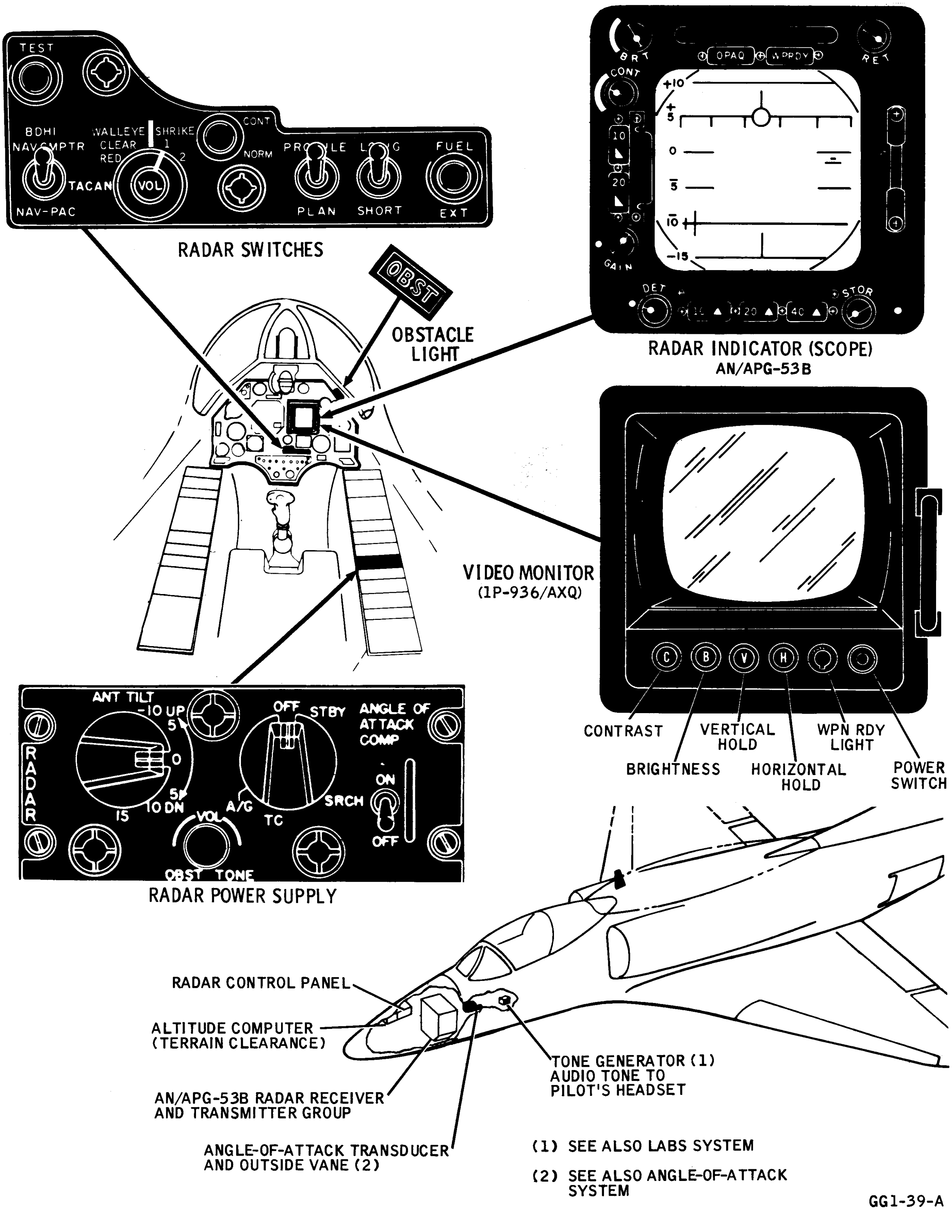


Figure 1-21. AN/APG-53B Radar System

3. PLAN-PROFILE switch . . . PROFILE

4. LONG-SHORT range switch . SHORT

5. Brilliance and storage knobs .desired picture

6. Gain and detail knobs . . . . . adjust for 3 degree beam resolution

7. Angle-of-attack switch . . . . ON (Target return should shift dependent upon aircraft angle of attack.)

TERRAIN CLEARANCE-PLAN MODE. After tuning set in PROFILE and observing the radar set operating properly, shift to PLAN. Point the aircraft at an obstacle or at the ground to provide a target within the range selected and note proper display on the indicator.

NOTE

No change in gain, detail, brilliance, or storage is required when changing between PLAN and PROFILE operation or between LONG and SHORT range.

AIR-TO-GROUND MODE. After observing the radar set operating properly in search, or the T/C modes, or after performing step 1 of the search mode procedure, perform the following steps:

1. Mode selector switch . . . . . A/G

2. Brilliance and storage knobs .desired picture

3. Initiate a dive of 10 degrees or greater so that the optical sight line intercepts the ground within 7 1/2 nautical miles. The horizontal bar on the scope should stop sweeping and begin to indicate the slant range between the nose of the aircraft and the intersection of the optical boresight line with the ground. Any type of terrain or choppy water is an acceptable target.

NOTE

- The LONG-SHORT switch, the PLAN-PROFILE switch and the gain and detail knobs are not functional in the air-to-ground mode.
- There is no obstacle warning in the air-to-ground mode.

EMERGENCY OPERATION AND MALFUNCTIONS

The angle-of-attack switch enables the pilot to remove the angle-of-attack compensation for line-of-flight reference for the various modes if the airflow sensor becomes inoperative. With the angle-of-attack switch in the **OFF** position, the zero line on the indicator is referenced to the armament datum line rather than to the flight path.

Because of its importance to the execution of the mission, the radar system has been designed so that many in-flight failures may be compensated for by normal pilot control adjustments. At any instant, the terrain clearance PROFILE mode presentation will indicate whether the equipment is transmitting, the location of the obstacle warning horizontal plane (normally positioned 1000 feet below the aircraft), and the instantaneous beam width of the system. For example, if the terrain return has widened, it can be corrected by advancing the detail knob clockwise. In the event of trouble in this channel which the detail knob will not compensate, the system may still be flown with the widened beam; but the widened video trace will cause the pilot to fly the aircraft higher than normal.

AN/APG-53B Radar System

On aircraft reworked per A-4 AFC 318, which provides Walleye weapons system capability, the AN/APG-53B radar system includes a television mode in addition to the existing capabilities of the AN/APG-53B radar system. The television mode was added by replacing the radar indicator (scope) and the addition of a new power supply.

The radar modes of operation are identical to those for the AN/APG-53A radar system. The AN/APG-53B radar scope (figure 1-21) has six control knobs and seven indicator lights on the front panel. Control knobs labeled BRT, STOR, DET, GAIN, CONT, and RET, and all range indicators are used when operating in the radar modes. Only three controls (BRT, CONT, and RET) and two indicators (OPAQ and WPRDY) are used in the television mode.

Refer to A-4/TA-4 Tactical Manual NAVAIR 01-40AV-1T for information regarding the television mode of operation.

SONY SCOPE

In aircraft reworked per A-4 AFC 395, which provides Walleye system capability, an IP-906A (Sony) television scope may be installed in place of the AN/APG-53A radar scope. The Sony scope has

no radar presentation capability and operates only in the television mode.

NOTE

Detailed description and operating procedures will be incorporated in the A-4/TA-4 Tactical Manual NAVAIR 01-40AV-1T by future revision.

AUTOMATIC FLIGHT CONTROL SYSTEM (AFCS)

The automatic flight control system (AFCS) is a completely transistorized system designed to provide pilot relief from routine control of the aircraft (figure 1-22). The AFCS will maintain heading, altitude and pitch and bank angles, and perform a coordinated turn to a preselected heading without use of the pilot control stick. These functions utilize attitude and direction information from the AN/AJB-3A all-attitude flight reference and bombing system. Without moving a switch or disconnecting the AFCS, the pilot can maneuver the aircraft in an unlimited manner throughout the AFCS envelope by using the control stick as in normal flight. Directional stability augmentation is active during AFCS operation or can be selected separately while on normal flight control. This yaw damping action is independent of pilot movement of the rudder pedals.

The AFCS has safety features which function automatically to ensure satisfactory operation and to prevent a system malfunction from damaging the aircraft or displacing the ailerons excessively. There are operating components which sense aircraft attitude and performance, and convert electrical control and correction input signals to mechanical signals for use by the aircraft hydraulic control surfaces. The hydraulic servos require utility system hydraulic power.

The AFCS is an electro-hydraulic system requiring all three phases of the 115/200-vac, 400-cycle power and 28-vdc power. Normal hydraulic system pressure of 3000 psi is reduced to 1500 + 75, -50 psi for the aileron and elevator servos and to 1150 + 450 -50 psi for the dual input rudder valve. The AFCS will not operate on the emergency generator and will not engage unless proper electrical and hydraulic power is available. It will disengage automatically if the electrical or hydraulic power fails.

Automatic Flight Control Panel

The control panel (figure FO-1 and FO-2) is labeled AFCS and is located on the left-hand console.

STANDBY SWITCH

Movement of the standby switch to STANDBY provides electrical power to the AFCS for warmup and automatic control synchronization to prevent engage transients. This switch should be in STANDBY at least 30 seconds prior to engaging the stability augmentation switch or the AFCS main engage switch. When this switch is placed in the OFF position, all toggle switches on the panel return to the OFF position.

ENGAGE SWITCH

Movement of the engage switch to the ENGAGE position turns on the AFCS in one of two modes; attitude hold or heading hold, depending on flight attitude.

In addition, the pilot can further select any one of three modes: control stick steering, altitude hold, and/or heading hold.

The switch may be placed in the OFF position at any time. The switch should not be placed in ENGAGE position until the standby switch has been in STANDBY position for 30 seconds.

The AFCS will not engage until the all attitude indicator OFF flag disappears.

When this switch is placed in the OFF position both the heading select switch and the altitude switch return to the OFF position. An abrupt lateral stick force of 40 pounds causes the aileron servo to bypass, which effectively disengages the AFCS lateral controls. The engage switch does not move from the ENGAGE position. Lateral control of the aircraft is then provided by the normal control system. To reengage the lateral servo, cycle the engage switch to the OFF position and then return to the ENGAGE position. This operation may be performed at any time.

Pressing the AFCS override button (AP) on the control stick causes the mode switches to move automatically to the OFF position. The AFCS can be reengaged by moving the engage switch to ENGAGE.

HEADING SELECT SWITCH

Movement of the heading select switch to the HDG SEL position starts the aircraft turning by the shortest route toward the heading selected on the heading select indicator by use of the SET knob. The heading select switch may be placed in the OFF position at any time. If placed in the OFF position prior to the completion of a turn, the aircraft will roll smoothly

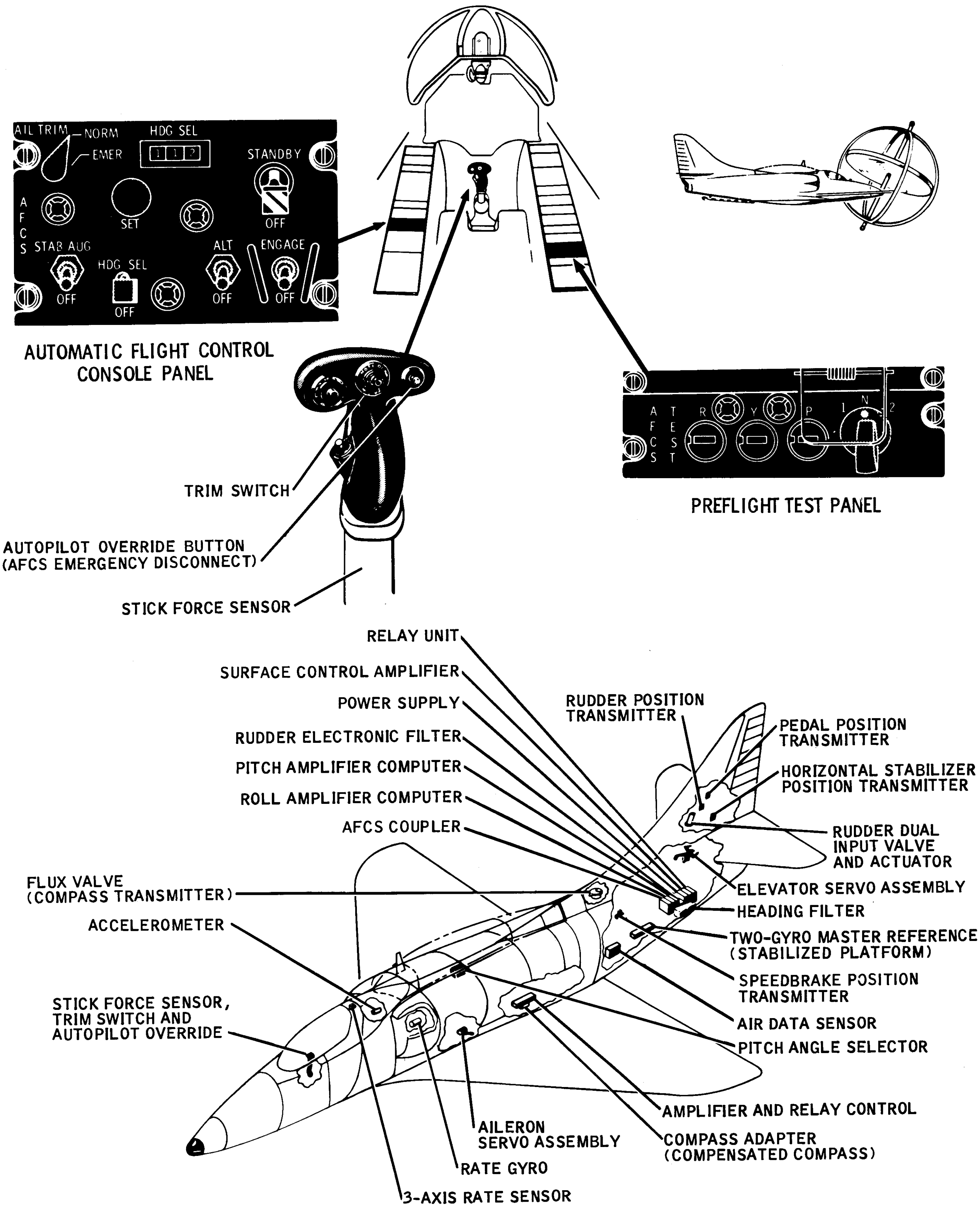


Figure 1-22. Automatic Flight Control System

to a level attitude and maintain the compass heading indicated at that time. If the SET knob is used to change the heading on the indicator while the switch is in the HDG SEL position, the following can occur:

1. If the aircraft is in level flight, sudden SET knob movement will result in abrupt aircraft lateral movement. If the SET knob is moved very slowly, small heading changes can be made satisfactorily.

2. If the aircraft is already in a preselect heading turn, the SET knob may be moved at any rate if the new selected heading is in the same direction as the turn and is less than 180 degrees away from the compass heading at the time of selection. Selection of a heading reciprocal to the present aircraft heading will cause the aircraft to reverse the turn abruptly. The HDG SEL switch will automatically move to the OFF position if the control stick steering mode is engaged.

NOTE

Pilot use of the SET knob within 5 seconds after placing the HDG SEL switch in the OFF position will cause an abrupt roll transient.

Upon engaging the HDG SEL switch, the approximate pitch attitude will be maintained during the turn. If a level turn is desired, the altitude hold mode should be engaged by moving the altitude switch to ALT.

ALTITUDE SWITCH

Movement of the altitude switch to the ALT position causes the aircraft to maintain the barometric altitude at actuation. If the mode is engaged in a climb or dive, the aircraft will return to the barometric altitude existing at the time of altitude switch engagement. The altitude switch cannot be engaged in climbs or descents in excess of 4000 feet per minute. The mode cannot be engaged if any force is being applied to the control stick. The switch will move automatically to the OFF position whenever control stick steering mode is engaged.

STABILITY AUGMENTATION SWITCH

Yaw damping action is provided when the engage switch is in the ENGAGE position or the stability augmentation switch is in the STAB AUG position.

AILERON TRIM NORM-EMERGENCY SWITCH

The aileron trim switch has two positions NORM and EMER. This switch is usually in the NORM position, but may be placed in the EMER position to provide aileron trim after the AFCS is disengaged, if aileron trim is not available in NORM. Movement of this switch to the EMER position also disengages and prevents reengagement of the AFCS, except stability augmentation, while in the EMER position. The AFCS can be reengaged after placing the switch in the NORM position.

Preflight Test Panel

This panel is the AFCS test panel on the right-hand console. The three indicators R, Y, and P measure dc control current to the AFCS servos for roll, yaw, and pitch respectively. The 1-N-2 switch is provided to obtain two test conditions. The switch is spring loaded in the N (normal) position and must be held in either test position 1 or test position 2. All test procedures are covered in PREFLIGHT PROCEDURE.

NOTE

The 1-N-2 switch must be in N position for normal AFCS operation.

Control Stick

AUTOPILOT OVERRIDE BUTTON

The control stick has an AFCS override button labeled AP. Pressing this button immediately disengages the entire AFCS.

SENSOR

Within the control stick is a force sensor which transmits signals of pilot applied stick forces to the control stick steering function of the AFCS.

CONTROL STICK TRIM SWITCH

The control stick trim switch, which is used to trim the aircraft in roll and pitch during normal flight, is inoperative during all AFCS modes except control stick steering. During the control stick steering mode, the lateral trim signal causes a trimming adjustment within the autopilot and not within the aileron power control as in normal control system

use. All pitch trim signals operate the horizontal stabilizer whether on control stick steering mode or normal flight controls.

NOTE

The control stick trim switch should be used with normal technique when control stick steering mode is engaged. Transients are minimized during disengagement or reengagement of control stick steering if the aircraft is correctly trimmed at that time.

AFCS Modes

The following modes of operation provide automatic flight control.

CONTROL STICK STEERING (CSS) MODE

The CSS mode provides for longitudinal and lateral control of the aircraft through the AFCS by pilot movement of the stick as in normal flight. This mode is engaged regardless of other modes selected or in operation by applying a force on the control stick grip of 2 pounds or more. Preselect heading and altitude hold modes are disengaged by use of CSS and they must be reengaged to be used again. The AFCS reverts from CSS mode to either attitude hold or heading hold mode when pilot force on the control stick is reduced below 2 pounds. The aircraft is controllable in all attitudes in CSS throughout the AFCS flight envelope, which is 4±1/2 positive-g, 1-1/2±1/2 negative-g, and one-half aileron deflection left or right. If these limits are exceeded, the AFCS disengages. The AFCS will not switch out of CSS at bank angles exceeding 70 degrees or pitch angles exceeding 60 degrees noseup or nosedown unless limits of acceleration or aileron deflection are exceeded.

NOTE

The control stick should not be released while in CSS if the pull-or-push force at the time exceeds 12 pounds because of large disengage transients. These transients are minimized if the aircraft is properly trimmed at the time of release.

ATTITUDE HOLD MODE

With an aircraft bank angle between 5 degrees and 70 degrees and a pitch angle less than 60 degrees noseup or nosedown, the aircraft lateral and longitudinal attitude at time of engagement of the AFCS or reversion from the CSS mode will be maintained.

HEADING HOLD MODE

If the pitch angle is within 60 degrees noseup or nosedown and the bank angle of the aircraft is less than 5 degrees upon engagement of the AFCS or reversion from CSS mode, the aircraft will be rolled to a level attitude and the heading and pitch angles at that time will be maintained.

PRESELECT HEADING MODE

Upon engagement of this mode after the heading has been preselected on the indicator, the aircraft will roll into a smooth turn to the preselected heading and then roll out on this heading. The turn will always be in the direction of the shortest route to the preselected heading. The bank angle will be maintained at 27±5 degrees under all conditions.

NOTE

The fixed bank angle of 27±5 degrees may cause the aircraft to buffet in an approach to stall if the preselect heading mode is selected below airspeeds ranging from 160 KIAS at 10,000 feet to 200 KIAS at 40,000 feet.

STABILITY AUGMENTATION MODE

The stability augmentation mode provides rudder yaw damping action which is that of pilot movement of the rudder pedals. The mode can be selected at any time without other AFCS functions. It is also in operation automatically during all other AFCS functions. The pilot must trim the aircraft directionally while using the AFCS in the same manner as he would when on the normal flight control system. If the aircraft is out of trim directionally, the following will occur:

1. A lateral engage transient will occur during change to the control stick steering mode.

2. The aircraft will be in a steady heading side slip in the heading hold mode.

ALTITUDE HOLD MODE

The altitude hold mode may be engaged when the rate-of-change of altitude is less than 4000±500 feet per minute. The aircraft will maintain the altitude at engagement. The aircraft automatically will pull out of its climb or dive and return to and maintain the engage altitude.

GROUND CONTROL BOMBING MODE

Refer to A-4/TA-4 Tactical Manual NAVAIR 01-40AV-1T.

Automatic Safty Features

The following automatic major safety features are incorporated in the AFCS.

AIRCRAFT STRUCTURAL PROTECTION

The AFCS is automatically disengaged and the engage switch automatically moved to the OFF position when normal load factor approaches 4±1/2 positive-g or 1 1/2±1/2 negative g, or when the aileron surface displacement exceeds 20 degrees, one-half lateral stick displacement from neutral. Normal acceleration values are reduced to 3 1/2±1/2 positive g and 1±1/2 negative g when a centerline store is carried, except when operating in CSS mode. (Refer to Control Stick Steering Mode.)

NOTE

The system in response to hardover signals disengages the AFCS with negligible upset in either noseup or nosedown attitudes. The incremental load factors, as a result of hardover signal, will vary between 0 g and 0.6 g for airspeeds up to Mach 0.85. Elevator surface rates in excess of 20 degrees per second disengage the AFCS with the same characteristics as hardover signals. For displacement rates of 5 degrees per second to 20 degrees per second at speeds in excess of 300 knots, structural limits are not exceeded. Altitude change from hardover to disconnect is less than 100 feet. This does not include the additional altitude necessary to recover to level flight.

AFCS TEMPORARY OVERPOWER

The AFCS can be overpowered temporarily laterally and longitudinally. Pilot application of 15 pounds longitudinal stick force will overpower the AFCS longitudinal control without affecting AFCS lateral or directional control. In the same manner a 35-pound lateral stick force will overpower the AFCS lateral control without affecting AFCS controls and will remain overpowered as long as the stick forces as noted are maintained.

NOTE

The only occasion to use the overpower feature will probably be to counteract a failure within the AFCS that would cause large deflection of the elevator or aileron. Unless prevented by the failure noted above, the AFCS will engage the control stick steering mode when the stick force is applied, and will disengage this mode when the stick force is reduced below 2 pounds.

AFCS LATERAL HYDRAULIC DISENGAGE

The lateral AFCS control can be disengaged by applying a sudden sharp force laterally to the control stick. This lateral disengagement allows the pilot to provide lateral control through the normal system but does not affect AFCS longitudinal control. AFCS lateral control may be reengaged by cycling the engage switch to OFF and then returning it to the ENGAGE position.

CONTROL STICK DISENGAGE

Pressing the AP button on the control stick will disconnect the AFCS electrically. The AFCS can be reengaged in the normal manner.

Preflight Procedure

The following preflight test procedure is recommended:

1. Landing gear handle . . . . DOWN
2. Engine rpm . . . . IDLE
3. All-attitude indicator power warning flag not visible.
4. Observe hydraulic power from movement of control surfaces and caution panel lights.
5. Standby switch . . . . STANDBY
6. Aileron trim emergency switch . . . . NORM
7. Stability augmentation switch . . OFF
8. Heading select switch . . . . OFF
9. Altitude switch . . . . OFF
10. Engage switch . . . . OFF

11. 1-N-2 switch. . . . . N

12. Heading select counter and set knob . . . . any preselected heading or position desired

NOTE

Two sets of preflight performance checks are provided here. The pilot should make the following four MANDATORY CHECKS before each flight when time is limited. If there is sufficient time available or after reworking or overhauling of the autopilot system, the COMPLETE PERFORMANCE CHECKS consisting of 18 items should be made.

MANDATORY CHECKS

These four checks are made in test position 2 and with the engage switch at ENGAGE.

1. Move the stick right. At about half deflection, the autopilot should disengage and the engage switch will be seen to slip to its OFF position. Recycle to engage switch to its ENGAGE position after centering the stick. Repeat the same check to the left. The results should be the same. This is the aileron limit switch check.

2. Move the control stick trim switch right. The autopilot should disengage and the engage switch will be seen to flip to its OFF position. Recycle the engage switch to its ENGAGE position after centering the trim switch. Repeat the same check to the left. The results should be the same. This is the load factor monitor limit switch check.

3. Move the stick aft (noseup) and move the horizontal stabilizer trim toward NOSE UP. The autopilot should disengage and the engage switch will be seen to flip to its OFF position. Recycle the engage switch to its ENGAGE position after centering the stick. Move the stick forward (nosedown) and move the horizontal stabilizer trim toward NOSE UP. The results should be the same. This is the trim monitor switch check.

4. Depress AP button. The autopilot should disengage and the engage switch will be seen to flip to its OFF position.

The pilot will know from the above tests that he has electrical power to the AFCS servos and that the safety circuits are operating.

5. Turn standby switch to OFF. Leave switch at OFF for takeoff.

NOTE

If all four AFCS mandatory checks are not satisfactorily completed, the AFCS STANDBY-OFF switch should be placed in the OFF position. STAB-AUG will not be available with the STANDBY switch in the OFF position.

COMPLETE PERFORMANCE CHECKS

It is recommended that these checks be made in the sequence given. There are four checks in TEST POSITION 1 and 14 checks in TEST POSITION 2. These 18 checks should be made if there is adequate time or after reworking or overhauling the autopilot system.

TEST POSITION 1 CHECKS. Hold the spring-loaded 1-N-2 switch in test position 1 until the following four tests have been completed. (The AFCS is unsynchronized.)

1. All three pointers (R, Y, and P) should deflect upward and remain positioned upward. This shows dc control current to the autopilot servos and indicates proper direction for surface movement.

2. Push on the right rudder pedal. The indicator needle in the Y (yaw) window should move from the upward position to a full down position. Sluggish rudder operation will be apparent, but is normal.

3. Actuate the engage switch to the ENGAGE position. It should not engage, because the AFCS should never engage while in an unsynchronized condition. If the switch does not flip back to the OFF position, report the trouble.

4. Actuate the stability augmentation switch to the STAB AUG position. It should remain engaged rather than flip back to OFF. Return switch to OFF position when test is completed.

TEST POSITION 2 CHECKS: Hold the spring-loaded 1-N-2 in test position 2 until the following 14 checks have been completed. (The AFCS is still unsynchronized.)

1. All three pointers (R, Y, and P) should again deflect upward and remain positioned upward.

2. Actuate the stability augmentation switch to the STAB-AUG position. It should engage, but the (Y) indicator for rudder should null (go to the center) because test position 2 closes the rudder loop. Leave the switch in the STAB AUG position for later checks.

3. Actuate the engage switch to the ENGAGE position. It should engage and the switch should remain engaged because test position 2 allows

engagement in the unsynchronized condition by bypassing the synchronizing monitors that normally protect the aircraft from engage transients (jumping). A small stick jump or movement normally accompanies engagement in position 2.

4. With the engage switch in the ENGAGE position (as in step 3), the P and R indicators for pitch (elevator) and roll (aileron) should null because the pitch and roll loops have been closed in test position 2.

5. Move the control stick for roll and pitch. It should feel normal.

6. Move the control stick hardover to the right. The engage switch should flip to the OFF position but the stability augmentation switch should remain engaged because the aileron has reached a position greater than half-travel from faired, and the protection circuit has caused the AFCS system to disengage.

7. Move the engage switch back to ENGAGE position. Move the control stick hardover to the left. The results should be the same as in step 6.

8. Move the engage switch back to ENGAGE position. Move the trim button to the right for right aileron. The results should be the same as in steps 6 and 7 because test position 2 feeds a test signal into the structural protection circuit.

9. Move the engage switch back to ENGAGE position. Move the trim button to the left for left aileron. The results should be the same as in step 8.

10. Move the engage switch back to the ENGAGE position. Actuate the aileron trim emergency switch to the EMER position. The engage switch should flip to the OFF position, but the stability augmentation switch should remain in the STAB AUG position. The emergency trim switch is to be used only with the AFCS disengaged, and this switch interlocks the AFCS engage switch as a protective measure.

11. Return the aileron trim emergency switch to the NORM position, but do not move the engage switch to its ENGAGE position at this time. Engage the AFCS by actuating the engage switch to the ENGAGE position. Then move the stick aft and, while holding an aft force on the stick, operate the stick trim button to trim the aircraft NOSE UP. The result should be that the autopilot disengages, the engage switch should flip to its OFF position and the stability augmentation switch should remain in its STAB AUG position. The test simulates the automatic trim circuit working improperly (making an out-of-trim condition worse).

12. With the switches left in the positions resulting from the check of step 11, engage the AFCS and make a similar test as in step 11, but push the stick forward and trim for a NOSE UP condition. The results should be the same as in step 11.

13. Reengage the engage switch, then depress the AP button on the stickgrip. The ENGAGE switch and the stability augmentation switch should flip to their OFF positions. This emergency switch removes all AFCS authority from the aircraft control system. Turn standby switch to OFF. Leave switch off for takeoff.

14. Release 1-N-2 switch and assure that switch returns to N position.

WARNING

Takeoff trim should always be checked after completion of the AFCS preflight check. Positioning the AFCS test switch to TEST POSITION 2 may have changed the trim setting.

Normal In-Flight Operation

TO ENGAGE STABILITY AUGMENTATION

1. Standby switch. . . . . STANDBY
2. Warmup period . . . . 30 to 90 seconds
3. Aileron trim emergency switch . . . . NORM
4. Heading select switch . . . . . . OFF
5. Altitude switch . . . . OFF
6. Engage switch. . . . . OFF
7. 1-N-2 switch . . . . N

CAUTION

Do not use the 1-N-2 switch while in flight.

8. Stability augmentation switch . STAB AUG

TO ENGAGE AFCS

Perform the above steps, then actuate the engage switch to the ENGAGE position.

NOTE

Engagement by use of the engage switch can be made without first using stability augmentation (STAB AUG). However, stability augmentation actuation is recommended first so that the pilot will have the stability augmentation mode after selecting OFF on the ENGAGE switch on the AFCS control panel.

TO DISENGAGE AFCS

The pilot may disengage the AFCS by one of the following actions:

1. Pressing control stick AP button.

2. Placing the standby switch in OFF position.

3. Placing both the engage and the stability augmentation switches in their OFF positions.

4. Depressing the PUSH TO SYNC button on the compass controller.

5. Moving the SET HDG switch on the compass controller.

6. Placing the aileron trim NORM/EMER switch in EMER position. In the event the switchover from automatic trim to manual trim malfunctions, or upon disengagement, the EMER position gives an additional switchover and will disengage the AFCS.

7. Moving the horizontal stabilizer manual override lever on the left console will manually overcome malfunction of the automatic pitch trimmer.

NOTE

Up to 4 seconds of override lever actuation may be required before disengagement occurs.

8. Pulling the emergency generator release handle.

LIGHTING EQUIPMENT

Interior Lights

The interior lighting system includes all instrument lights, console lights, and cockpit floodlights. A light is mounted in each instrument lens (except the oil pressure gage) to provide equal illumination over the entire face of the instrument. Two floodlights are mounted on each side of the gunsight beneath the glareshield to provide auxiliary or emergency lighting of the instrument panel. A white kneeboard floodlight incorporating a red filter is mounted on the gunsight support on the right-hand side to provide lighting for the pilot's kneeboard. Six red floodlights are installed to provide auxiliary or emergency console lighting. Four white floodlights are provided for auxiliary cockpit lighting for use with the thermal radiation closure. Instrument and console lights and the red floodlights are operative on emergency generator.

INTERIOR LIGHTS CONTROL PANEL

An interior lights (INT LTS) control panel (figure 1-23) mounted on the right console, contains switches for the operation of all interior lights except the four high-intensity white floodlights. Two rotary switches, marked INST and CONSOLES are turned clockwise from OFF to turn on the instrument lights and console lights, respectively. Additional turning in a clockwise direction toward the BRT position increases the intensity of the light.

Two rotary switches (on aircraft not reworked per A-4 AFC 428) marked INST and CONSOLES are turned clockwise from OFF to turn on all instrument and console lights, respectively.

On aircraft reworked per A-4 AFC 428, three rotary switches marked PRIM INST, CONSOLES, and SEC INST afford individual control of the primary, left and right consoles, and secondary instrument lighting. Placing the PRIM INST switch clockwise from OFF will turn on the altimeters (radar and barometric), airspeed, all-attitude, and BDHI indicator lights. Placing the CONSOLES and SEC INST switches clockwise from OFF will turn on the console lights and secondary instrument lights, respectively. The brightest lighting will be reached at full clockwise rotation of any switch. The primary instruments can be adjusted to bright by pilot selection, while all other lighting is dimmed, resulting in a more compatible lighting environment for the pilot.

NOTE

When the INST lights switch (SEC INST for aircraft reworked per A-4 AFC 428) is in any position other than OFF, the ladder lights are dimmed for night operations and may not be visible in daylight.

A toggle switch with three positions, BRT, DIM, and MED, controls the intensity of the red floodlights after the CONSOLES switch is turned from the OFF position. The pilot's kneeboard floodlight has separate intensity control on the case.

The four high-intensity white floodlights, two for the instrument panel and one for each console, have a common control installed above the right-hand console on the fuselage skin. Clockwise rotation from the OFF position turns the floodlights on dimly and further clockwise rotation increases the intensity.

Exterior Lights

The exterior lights system includes position lights, fuselage wing lights, air refueling probe light, an approach light, and a taxilight. A semiflush, white, high-intensity gas discharge and low-intensity filament fuselage wing light is located under the leading edge of each wing. The aircraft has two flashing red anticollision beacons, one mounted on the top of the fuselage and the other mounted on the left main leading gear strut fairing. The angle-of-attack approach lights are mounted in the leading edge of the left wing (figure 1-24). The taxilight is installed on the right-hand main landing gear door.

The air refueling probe light is located on the right-hand intake duct forward outboard lip (figure 1-24).

Wingtip, tail, and fuselage lights are actually double lights, as both filament and gas discharge types are

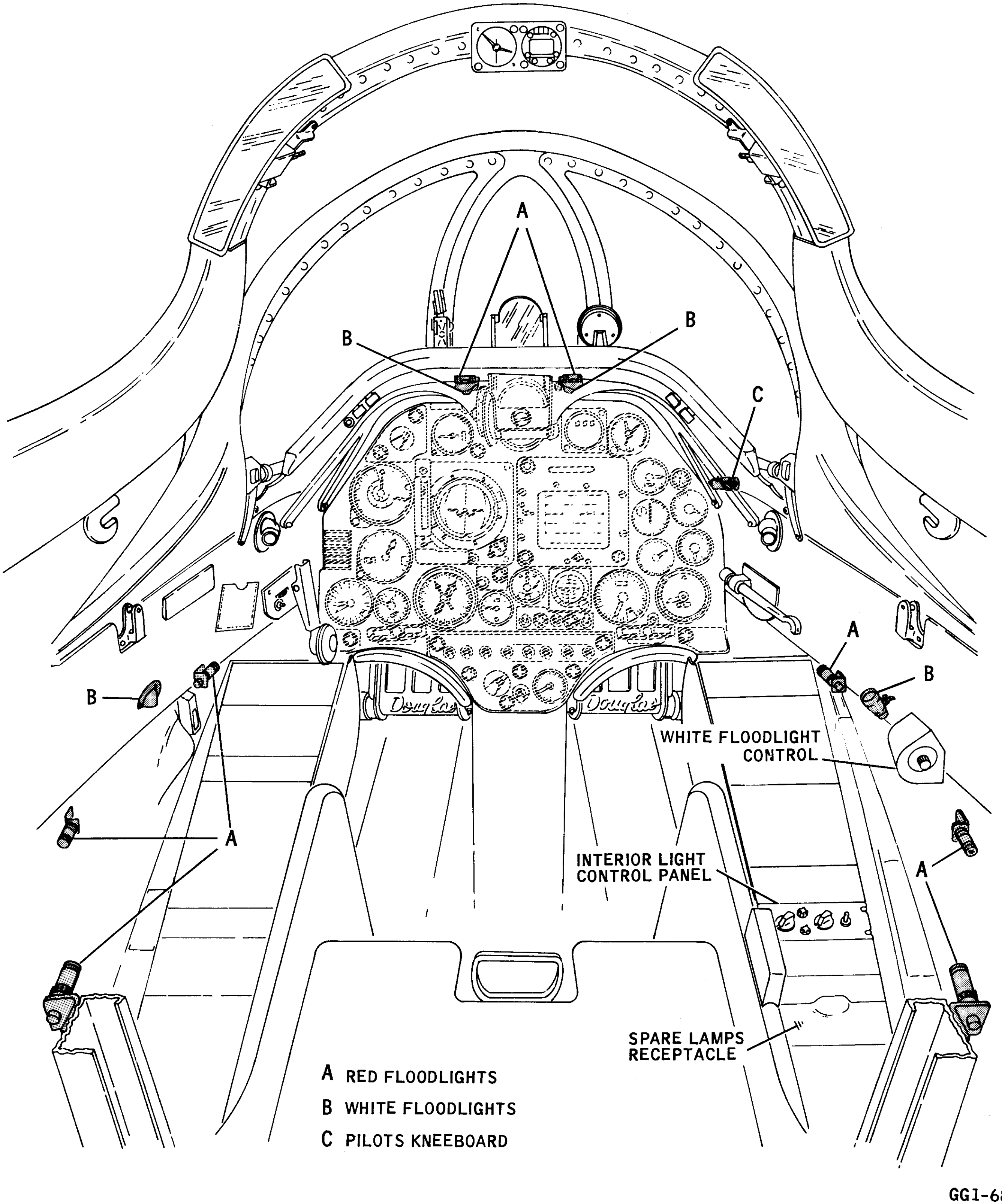


Figure 1-23. Interior Lights

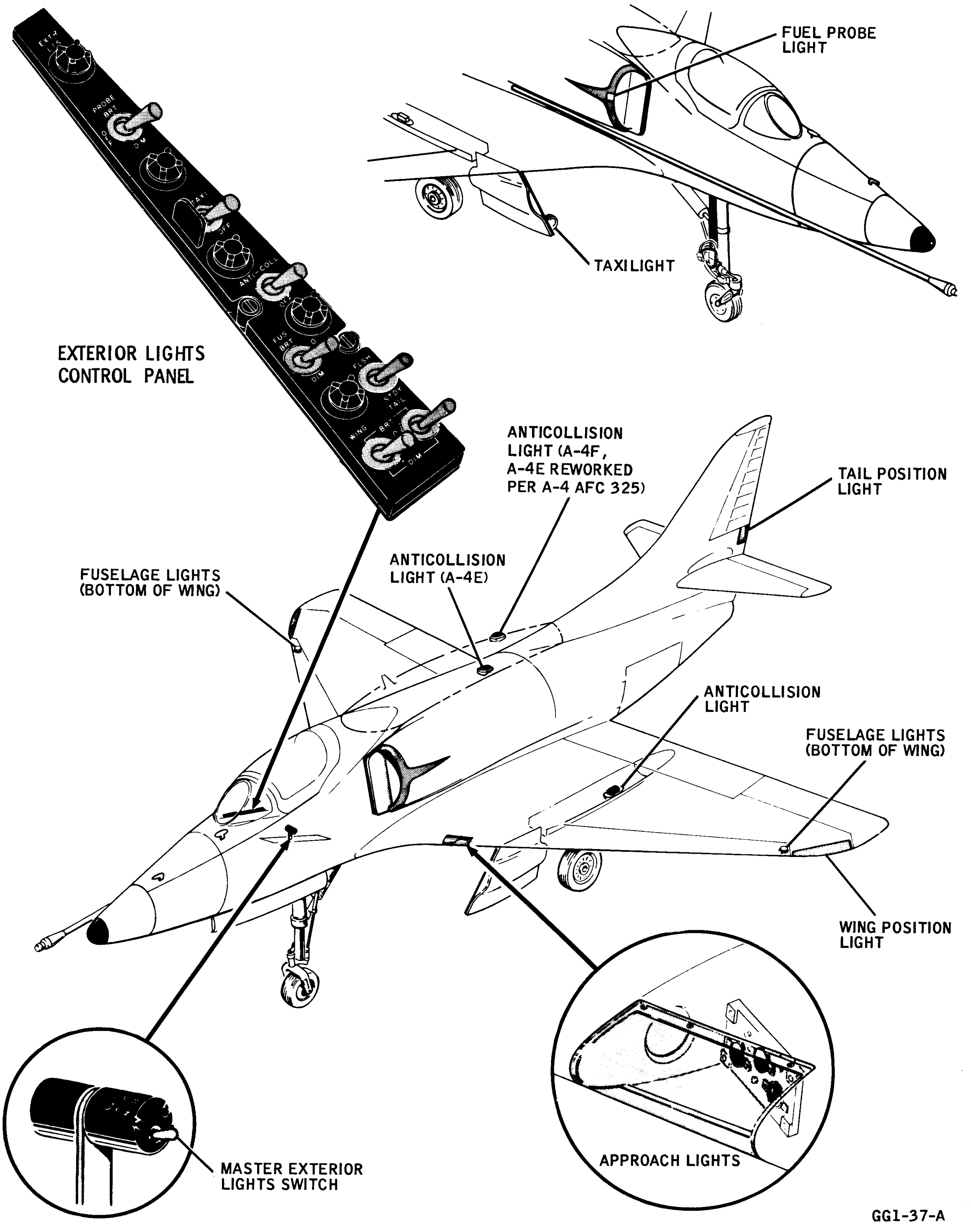


Figure 1-24. Exterior Lights

provided. The BRT (bright) position directs power to the gas discharge lights; the DIM position directs power to the filament lights.

NOTE

The only exterior lights that will operate on emergency generator power are the approach lights.

EXTERIOR LIGHTS CONTROLS

MASTER EXTERIOR LIGHTS SWITCH. A master exterior lights switch (figure 1-24), on the outboard side of the throttle grip, controls power to the exterior lights. The switch has a forward ON position, a center OFF position, and an aft momentary ON position. The master exterior lights switch is spring loaded from the aft to the center position, providing a means of signaling with the exterior lights.

CAUTION

With external lights on BRT, application of external power or starting the aircraft may cause failure of the lights. Allow 60 seconds for warmup after electrical power is applied to aircraft.

EXTERIOR LIGHTS CONTROL PANEL. An exterior lights control panel (figure 1-24) on the right console contains switches for functional control of the exterior lights.

APPROACH LIGHT OPERATION

The approach light circuit is controlled by a tailhook switch, a landing gear microswitch, and by a manually operated tailhook bypass switch. When the master exterior lights switch on the throttle is ON, the approach lights are automatically dimmed for night operations. Approach lights will operate on emergency generator power.

AIR CONDITIONING AND PRESSURIZATION SYSTEM

A combination air conditioning and pressurization system heats, cools, ventilates, and pressurizes the cockpit. The system comprises an air cycle system refrigeration unit, cockpit pressure regulator, pressure relief valve, and temperature control components. (See figure 1-25 for a schematic of the air conditioning and pressurization system.)

Air Conditioning

Hot high-pressure air is bled from the engine compressor section, and is ducted either through or around the refrigeration unit, as governed by a cockpit temperature controller. Air passing through the refrigeration unit is directed through a heat exchanger and turbine, where it is expanded and cooled. The cooled air from the refrigeration unit is further mixed with hot air which has bypassed the unit, and is delivered to the cockpit. The degree of mixing of the conditioned air is controlled automatically by an air temperature control valve, which maintains the air at the temperature selected from the cockpit.

The airconditioning system is a delivered air temperature control system. Since the console control calls for a fixed temperature of the air as it enters the cockpit, the pilot must change the setting as cockpit heating and cooling loads change. Position of the temperature control knot is not an indicator for pilot comfort. Under certain flight conditions, full cold will provide comfort; under other conditions, full hot may be required. The pilot, therefore, must adjust the control to maintain a comfortable cockpit.

Pressurization

When the air conditioning system is in normal operation, the air provided for heating, cooling, and ventilation is also used to pressurize the cockpit. The pressurizing schedule (figure 1-26) provides for cockpit pressure to equal atmospheric pressure from sea level to 8000 feet altitude. The cockpit pressure at 8000 feet is then maintained to an altitude of 17,000 feet. From this point on, the cockpit pressure is maintained at 3.3 psi above the existing atmosphere pressure. Cockpit pressure is shown in terms of altitude by the cabin altimeter (figure 1-25), located on the right side of the armament panel.

In order to prevent excessive positive or negative pressure differentials because of possible malfunctioning of the pressure regulator, a pressure relief valve opens at a positive pressure differential of 3.6 psi and at a negative differential of minus 0.10 psi. The pressure relief valve also incorporates an emergency feature which allows it to dump cockpit pressure when the cockpit pressurization switch is placed in the RAM position.

Air Conditioning Control Panel

The air conditioning control panel (figures FO-1 and FO-2), is located outboard of the right-hand console. It contains a two-position level lock toggle switch for operation of the cabin pressurization system, a rotary cabin temperature control knob, and a three-position windshield defrost switch.

CABIN PRESSURE SWITCH

The cabin pressure switch is marked RAM and NORMAL. When NORMAL is selected, and the canopy is closed, the cockpit is sealed and pressurized by engine compressor bleed air. Pressurization is automatically maintained at a predetermined schedule by the cockpit pressure regulator. The RAM position

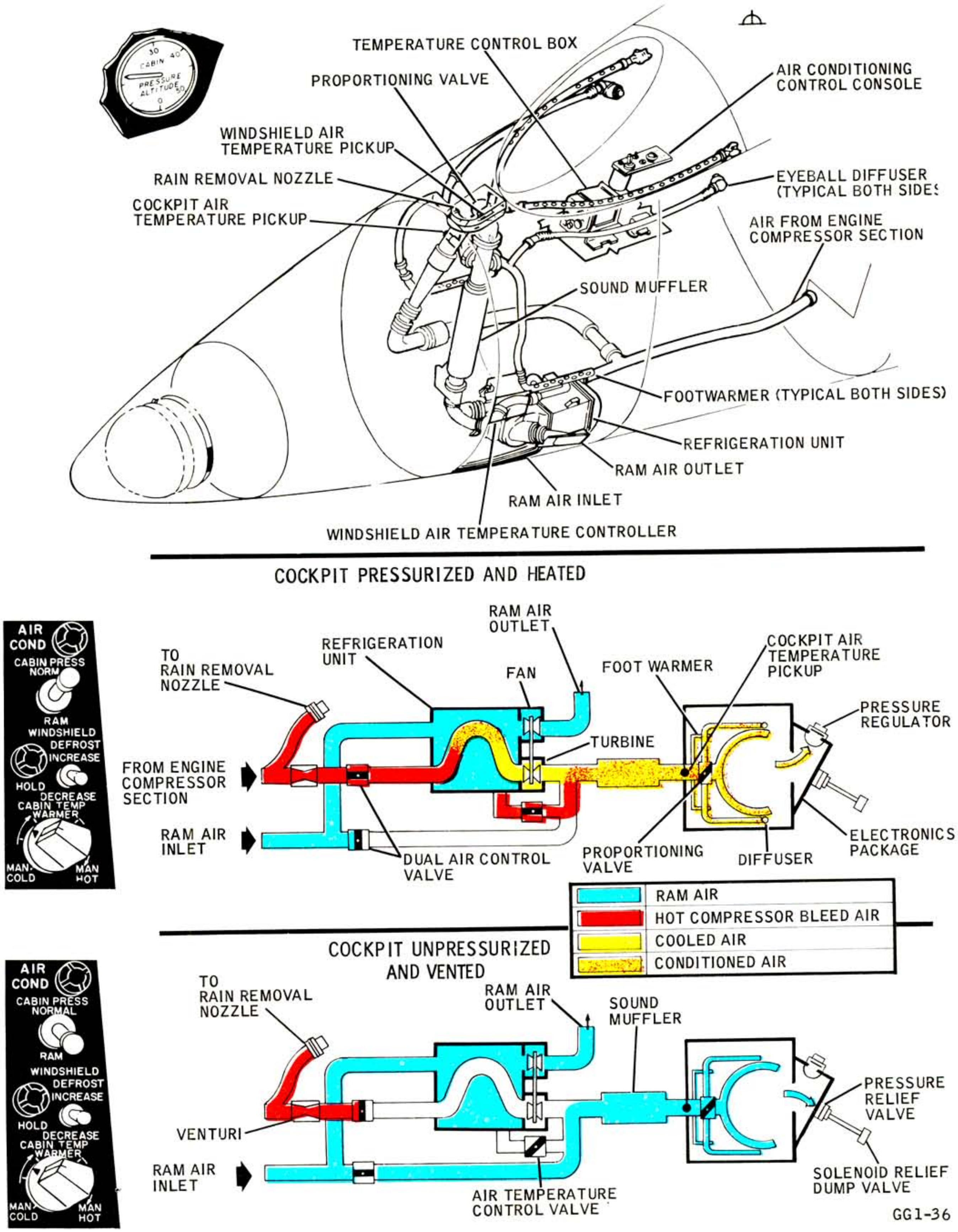


Figure 1-25. Air Conditioning and Pressurization System

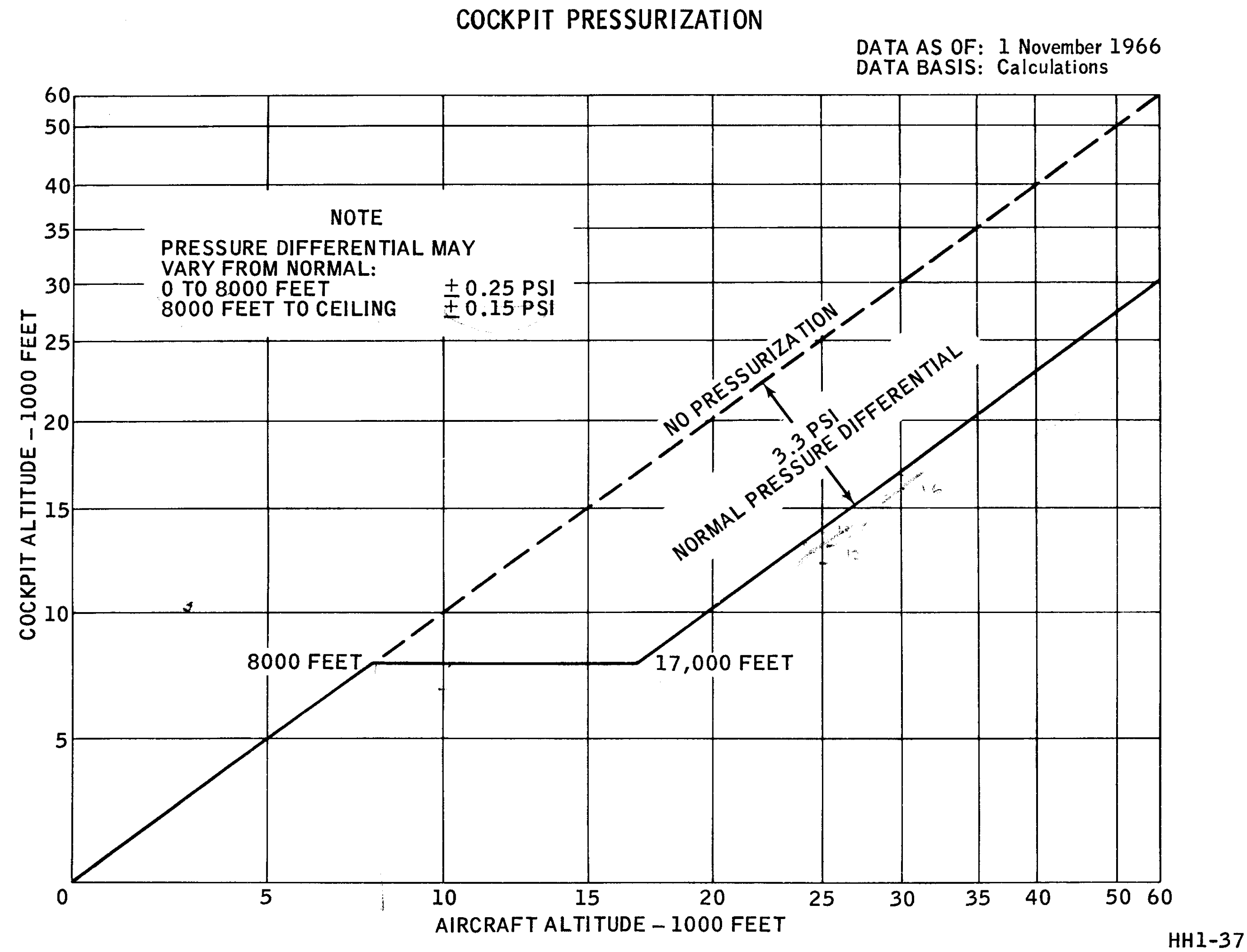


Figure 1-26. Cockpit Pressurization Chart

electrically opens a pressure relief valve to dump cockpit pressure and opens a motor-driven valve in the ram air duct allowing outside air to ventilate the cockpit. Selecting RAM also closes off engine bleed air to the air conditioning system.

CABIN TEMPERATURE CONTROL

Marked positions of the rotary cabin temperature control are MAN COLD, MAN HOT, and WARMER. The control is functional whenever the cockpit pressurization switch is in the NORMAL position. In normal operation, the control is set in the arc (from 10 o'clock to 2 o'clock) designated WARMER which provides the desired cockpit temperature. In the event of a malfunction in the normal temperature control circuitry, manual temperature control is provided by rotating the temperature control past a detent to the MAN COLD or MAN HOT positions. These positions bypass the automatic temperature control circuitry and changes the mixing of hot and refrigerated air in the selected direction as long as the control is held in position. The temperature control is spring loaded away from the MAN COLD and MAN HOT positions (7 o'clock and 4 o'clock, respectively) and must be held firmly in the desired position against this spring pressure. When released from the MAN COLD or MAN HOT positions, the temperature control is in a hold condition and the mixing valve motor is deenergized. The temperature control must be held in either position for at least 8 seconds to allow complete repositioning of the temperature control valve. If the air conditioning unit fails or loses electrical power, the cockpit air temperature control valves will remain in the same position and the cockpit pressure will remain as is.

WINDSHIELD DEFROST SWITCH

The windshield defrost switch is marked INCREASE, HOLD, and DECREASE and controls a motor-driven proportioning valve which serves to proportion air between the windshield defrost manifold and the footwarmers. Air directed to the footwarmers is also shared with the "eyeball" diffusers. The "eyeball" diffusers may be turned on, off, or to any intermediate position by rotation of the diffuser nozzle and may be directed to provide airflow in the most comfortable direction by manual adjustment of the diffuser in its

ball-socket base. When the defrost switch is placed in INCREASE. the proportioning valve is operated to a position which increases the proportional airflow to the windshield. If allowed to remain in this position for several seconds. all air entering the cockpit will be directed to the windshield defrost manifold. When the defrost switch is placed in its momentary DECREASE position. the proportioning valve decreases the airflow to the windshield and increases the airflow to the footwarmers (and eyeball diffusers if opened) as long as the switch is held in DECREASE, or until the proportioning valve reaches its limit. At this time. all air is bypassing the windshield defrost manifold and is directed into the footwarmers (and eyeball diffusers if opened). The HOLD position allows the proportioning valve to remain as is.

Defrost

Defrosting of the windshield side panels is accomplished by windshield defrost air as described in preceding paragraph.

Frosting of the bullet-resistant glass center panel of the windshield is prevented by electrical means. This system is energized when the main generator is operating or when external power is supplied. A transparent layer within the glass panel provides resistance for electrical heating. and a sensing element contained in the panel causes a heating controller to regulate automatically the temperature of the surface to maintain it between two predetermined limits.

Windshield center panel defrosting also functions when the emergency generator is extended. With the emergency generator extended. a switch in the system automatically shuts off the heating element when the landing gear handle is moved to the DOWN position. To minimize fogging of the center panel when the emergency generator is extended, delay lowering the landing gear as long as possible in the landing sequence.

Cockpit Fog and Snow Suppression

Small quantities of fog, light snow. or ice will frequently appear at the air-conditioning outlets. A screen has been added to the manifold connection to prevent ice from being emitted from the distribution system. While this is a normal condition resulting from rapid cooling of air by the air conditioning unit, an excessively large volume of fog which obstructs vision can occur under extreme conditions of high humidity and high ambient air temperatures at low altitude. This fog may be eliminated by adjusting the cabin temperature control knob for higher cabin temperature, or by adjusting the windshield defrost switch to decrease the flow of air to the windshield defrost ducts and closing the "eyeball" diffusers, thereby dumping the fog and snow to the footwarmers. In some cases the ducting may have cooled to a point where fog will persist for a short time after the cockpit temperature has been increased. After the fog has been suppressed. a temperature setting should be selected that will provide the most comfortable temperature above the fogging point.

ANTIBLACKOUT SYSTEM

The antiblackout system utilizes high-pressure engine bleed air. Air is filtered and directed through a line to the valve located on the anti-g and oxygen panel on the left-hand console (figures FO-1 and FO-2). The valve control knob can be turned to HI or LO to regulate the amount of air pressure increase in the anti-g suit. As g-forces are reduced. the valve will automatically reduce the pressure in the suit. A pushbutton on the top of the valve control knob may be manually operated to test the system. If the valve has any tendency to stick or fails to return to the closed position. it should be replaced. On long flights. this system makes it possible for the pilot to inflate the suit occasionally for body message to lessen fatigue. The antiblackout suit connection plugs into a receptacle adjacent to the control knob.

NOTE

In the event of inadvertent g-suit hose disconnect. noticeable chattering in the valve may occur during accelerated flight.

ANTI-ICING SYSTEM

Engine

The engine anti-icing system is designed to prevent ice formation. and safe operation requires that the pilot anticipate the possibility of ice formation whenever these weather conditions exist.

Ice formation in the engine air inlet section is prevented by an integral powerplant system that utilizes hot high-pressure bleed air from the compressor section. Air bled from both sides of the compressor discharge is piped forward through external lines and distributed through the inlet guide vanes from which it is ported into the engine inlet airstream.

Anti-Icing Control

Electrical control of the anti-icing system is accomplished by placing the anti-icing switch (figures FO-1 and FO-2), located outboard of the right-hand console, in ALL position. The switch in this position

directs power to the anti-icing valve and regulator mechanism on the external lines. It also actuates the heating element of the pitot tube.

NOTE

Operation below approximately 75 percent rpm may not supply sufficient heat to keep the engine air inlet ducts clear of ice.

PITOT AND ANGLE-OF-ATTACK VANE

The pitot tube is electrically heated at all times when the anti-icing switch is in the ALL or PITOT position and the aircraft is airborne. The angle-of-attack vane is automatically heated whenever the aircraft is airborne and is independent of the anti-icing switch position.

RAIN REMOVAL SYSTEM

The rain removal system utilizes high-pressure engine bleed air to remove rain from the bullet-resistant glass center panel of the windshield. Hot, high-pressure bleed air is ducted to the rain removal automatic pressure regulating unit. The pressure regulating unit allows constant pressure air to be delivered to the jet pump unit. The jet pump unit mixes the hot bleed air with ambient air and delivers it to a nozzle that directs the high-velocity hot air over the windshield surface. Electrical control of the system is maintained by the rain removal control panel located on the wedge outboard of the right-hand console. The rain removal system is inoperative on emergency generator.

Rain Removal Control Panel

The rain removal control panel (figures FO-1 and FO-2) has two switch positions labeled RAIN REMOVAL and OFF. When the switch is placed in the RAIN REMOVAL position, hot high-pressure air is directed over the windshield surface. The OFF position of the switch cuts off the air. In the event of electrical power failure, the valve in the pressure regulating unit automatically closes, shutting off the system.

Normal Operation

ON THE GROUND

Rain removal airblast temperatures are a function of engine power setting. At IDLE power, airblast temperature is not sufficiently hot to cause damage to the windshield and the system may be operated continuously. However, at MILITARY, the temperature becomes extremely hot, and the operation at high-power settings is limited to a maximum of 3 minutes.

CAUTION

Exceeding this limit could cause bubbling of vinyl layers and cracking of the glass.

The pilot may check the rain removal system after engine starting by noting the warm airblast over the top of the windshield. The rain removal switch should always be placed in the OFF position immediately after the preflight check to prevent inadvertent operation at high-power settings and subsequent damage to the windshield. On takeoff, if the rain removal system may be required, the switch should be placed in RAIN REMOVAL just prior to the takeoff run.

IN THE AIR

The rain removal system may be used for extended periods of time during approach and landing due to the lower power settings usually required for this phase of flight.

CAUTION

- During a waveoff when power settings are required, the 3-minute limitation at MILITARY power applies.
- The jet blast rain removal system was designed to operate during approach, landing, takeoff, waveoff, and taxi. Operation other than these is recommended only under emergency flight conditions in which forward visibility is necessary. Systems operation at high altitude may cause cracks in the outer glass ply of center windshield panel due to extreme thermal shock to the glass.

RAIN REPELLENT SYSTEM

The rain repellent system is used to improve visibility during flight through heavy rain. A pushbutton, labeled RAIN REPELLENT, is located above the left console just below the left eyeball diffuser. When the button is pressed, a metered amount of repellent

is sprayed onto the windshield. The repellent fluid container and fluid gage are located in the nose compartment. Fluid level may be checked by opening the APX access door.

NOTE

The rain repellent system is inoperative during emergency generator operation.

AIR REFUELING (TANKER SYSTEM)

The air refueling system enables the aircraft to serve as a tanker for other aircraft. Fuel from the wing tank and the drop tanks may be transferred to the refueling store. All fuel in the tanker aircraft except that contained in the fuselage tank may be transferred to the receiver aircraft.

Air Refueling Store

The refueling store carried on the centerline rack contains a 300-gallon fuel cell, a constant speed ram air turbine-driven hydraulic pump, a hydraulically driven fuel pump, a hydraulically operated hose reel, and 50 feet of refueling hose with a drogue. The store is capable of transferring fuel to the receiver aircraft at approximately 180 gallons per minute (figure 4-8). Provisions are made for dumping fuel overboard if necessary.

Air refueling stores, reworked per Accessory Change 86, incorporate a fuel quantity probe within the store. Air refueling stores, with this change incorporated, will provide fuel quantity when the external fuel quantity switch is actuated, the same as a drop tank.

The operational envelope of the store with the drogue extended is limited to 300 KIAS or 0.80 Mach, whichever is lower, at altitudes up to 35,000 feet. See section XI, part 6, for the complete operational envelope and fuel available for transfer.

AIR REFUELING STORE LIGHTS

At the end of the refueling store are two lights, amber (left side) and green (right side). These lights are of use only to the receiver aircraft. The amber light comes on when the hose is extended, indicating that the receiver aircraft may now engage the drogue. After engagement, the receiver must move forward (3 to 6 feet) until the amber light goes off. The green light indicates that fuel is actually flowing from the tanker to the receiver.

NEW Air refueling stores reworked per Accessory Change 33 provide for illumination of the hose and drogue to facilitate night refueling. Lights added by this change consist of two white lights mounted in the aft section of the store for illumination of the hose, and four white lights mounted in the drogue assembly. The hose lights come on when the drogue switch is placed in the EXT position and go off when the drogue switch is placed in the RET position. The drogue lights are furnished power by an air-driven generator mounted in the drogue assembly and are on continuously while the drogue is extended into the airstream.

Air Refueling Control Panel

The refueling control panel located forward on the left console contains all the indicators and switches used to operate the system (except the drop tank pressurization switch). The system is designed so that any sequence of switch positioning is possible without causing damage or malfunction to the tanker store.

DROGUE POSITION INDICATOR

The drogue position indicator has three possible indications: RET (retracted), EXT (extended), or TRA (transfer). The indication will be RET only when the drogue is fully retracted or during drogue extension. The indicator indicates EXT only when the drogue is fully extended and ready for receiver engagement. TRA is indicated only when the hose and drogue has been engaged and approximately 4 feet of hose retracted onto the store reel and also during hose retraction until the drogue is fully retracted.

GALLONS DELIVERED COUNTER

The gallons delivered counter registers the gallons of fuel transferred through the hose and drogue to the receiver in increments of 2 gallons. A reset knob is provided to reset counters to zero when desired.

REFUELING MASTER SWITCH

The refueling master switch has three positions: ON, OFF, and DUMP. When the refueling master switch is placed ON, it unlocks and unfeathers the air-driven propeller at the forward end of the refueling store. When placed in OFF, it feathers and locks the propeller. When the switch is placed in DUMP, an electrically operated fuel dump valve in the bottom of the refueling store opens to dump fuel. To place the switch in DUMP, first depress the spring-loaded lever guard; then, lift the switch from its spring-loaded safety position. NEW

STORE DUMP LIGHT NEW

A store dump light is incorporated on control panels modified by Accessory Change 1. The light is on when fuel is flowing through the dump valve or from the store to the aircraft. When fuel flow ceases either because of fuel depletion or because dump/transfer has been secured, the light goes off. A press-to-test feature for the bulb is incorporated but is energized only when the SHIP-TANK Switch is in the FROM STORE position. NEW

DROGUE SWITCH

The drogue switch controls the hose and drogue positioning and is marked RET and EXT. When the refueling master switch is ON and the drogue switch is placed in EXT, the hose will extend to trail position. Extension of the drogue energizes a bypass relay. This relay prevents feathering of the air turbine regardless of the position of the refueling master switch until the drogue is fully retracted. When the drogue switch is positioned at RET, the hose will retract.

NOTE

On air refueling stores incorporating Accessory Change No. 33, the drogue switch also controls the white lights in the aft section of the store that were provided for illumination of the hose.

FUEL TRANSFER SWITCH

The fuel transfer switch controls the flow of fuel after proper hookup is made. The switch must be at TRANS before fuel will transfer. Fuel flow will stop any time this switch is placed in OFF. A holding relay is provided which causes the switch to remain in the TRANS position until store fuel is depleted or the pilot places it in OFF.

LIGHT SWITCH

The light switch determines the brightness of the amber and green lights at the aft end of the refueling store. The switch has two positions: BRT for daylight fueling, and DIM for night. With the switch in DIM, store lights will not be visible during daylight.

SHIP-TANK SWITCH

The ship-tank switch has three positions: TO STORE, OFF, and FROM STORE. The TO STORE position permits fuel to flow from the wing tank to the refueling store. When the switch is placed at FROM STORE, fuel will flow under engine air pressurization from the air refueling store and drop tanks to the wing tank.

HOSE JETTISON SWITCH

The hose jettison switch is provided to cut and crimp the store hose in the event of a store malfunction which precludes drogue retraction. It also removes all electrical power from the store controls except for the refueling master switch. The hose jettison switch must be kept in the forward OFF position at all times unless jettisoning of the hose and drogue is required during an in-flight emergency. To move the hose jettison switch to HOSE JETTISON, first hold back the spring-loaded channel guard then lift the switch from its spring-loaded safety position. Be sure that this switch is in its forward OFF position before electrical power is applied. Once the HOSE JETTISON position is selected, do not return it to its forward OFF position as the turbine will unfeather and cause the hose to be pulled from the guillotine crimper spilling fuel in the store and creating a fire hazard.

DROP TANK TRANSFER DURING AIR REFUELING

To use the fuel in the drop tanks for air refueling, place the drop tank pressurizing switch in PRESS. This provides normal drop tank transfer to the wing where it may then be used for transfer to the store by means of the SHIP-TANK switch.

NOTE

When the SHIP-TANK switch is in the FROM STORE position, fuel in the drop tanks will automatically be transferred to the wing regardless of the position of the drop tank transfer switch on the engine control panel.

Air Refueling (Receiver) System

During air refueling, fuel flows through the receiver aircraft's probe nozzle under pressure and is distributed to each tank in the same manner as it is through the pressure fueling receptacle.

JET-ASSISTED TAKEOFF SYSTEM

A two-bottle JATO system provides the aircraft with additional thrust during takeoff. A JATO bottle is mounted on each speedbrake (figure 1-4). Each bottle is capable of producing 4500 pounds of thrust for a period of 5 seconds. The bottles are fired electrically and jettisoned hydraulically by utility system hydraulic pressure controlled through a solenoid operated selector valve.

JATO Control Panel

The JATO control panel, located outboard of the left-hand console (figures FO-1 and FO-2), contains the following controls for arming and jettisoning of the JATO bottles; the JATO arming switch, the JATO jettison switch, and a press-to-test type JATO arming caution light.

JATO ARMING SWITCH

The JATO arming switch is a two-position lever-lock toggle switch labeled ARMED and OFF. To place the switch in the ARMED position, the spring-loaded toggle lever must be lifted. This arms the JATO firing circuit by energizing the JATO firing button on the catapult handgrip and the jettison circuit to the jettison switch.

JATO ARMED INDICATOR LIGHT

A JATO armed indicator light on the control panel comes on when the arming switch is energized. The press-to-test feature of this light tests the bulb.

JATO JETTISON SWITCH

The JATO jettison switch on the control panel is a guarded, momentary-control toggle switch, spring-loaded to the SAFE position. In the JATO JETT position the switch energizes a solenoid-controlled hydraulic selector valve which directs hydraulic pressure to the JATO mounting hook actuating cylinders. The mounting hooks are actuated to release both JATO bottles simultaneously.

CAUTION

When JATO bottles are installed, operation of the emergency speedbrake control will force the JATO bottles off the aircraft resulting in airframe damage.

NOTE

An interlock in the speedbrake electrical circuit prevents normal operation of speedbrakes with JATO bottles attached. Be sure the speedbrake switch on the throttle is in the CLOSED position prior to jettisioning the JATO bottles; otherwise, upon release of the JATO bottles the speedbrakes will open.

JATO FIRING BUTTON

The JATO firing button (figures 1-5 and 1-6), located at the end of the catapult handgrip energizes a relay which completes the circuit to the firing mechanism. Refer to section XI, Performance Data, for additional information on takeoff airspeeds with JATO and distances at which the JATO bottles are fired.

WARNING

To prevent possible JATO system accidents, the JATO arming switch in the cockpit shall be at OFF and a no-voltage test shall be made at the aircraft igniter terminals prior to attaching the JATO igniter leads to the bottles.

BANNER TOW TARGET EQUIPMENT

Equipment consists of a banner target towline, and Mark 51 bomb rack and adapter suspended from an AERO 7A-1 bomb rack on the aircraft centerline station.

Targets

Standard Navy or Air Force 7 1/2 x 40 feet or 6 x 30 feet banner targets may be utilized.

Towline

Recommended towline configuration is 1950 feet of 7/16-inch nylon towline attached to 50 feet of 7/32-inch armored cable leader. The armored cable leader is required at the tow plane end of the towline to prevent burn through which will occur if an all nylon towline is used.

Aircraft Towline Attachment

For detail on the Mark 51 bomb rack and adapter installation on the AERO 7A-1 bomb rack, refer to the pertinent aircraft armament bulletin.

MISCELLANEOUS EQUIPMENT

Thermal Radiation Closure

A thermal radiation closure may be installed on the canopy structure for use on missions requiring pilot protection from the heat and light produced by nuclear explosions.

The closure consists of fixed fiberglass panels and a manually actuated segmented telescoping hood (buggy top) attached to the canopy. The glareshield installation includes light seals and an extension on the aft end. When the canopy is closed, the fixed panel on the canopy matches the glareshield in contour and

forms a glareshield extension. The buggy top pivots down and forms a light seal with the fixed panel completely sealing the pilot within a thermal protective covering. Attached to the forward segment of the buggy top are right and left handholds for opening and closing as required. The right handhold contains a latching mechanism for locking the buggy top in the open (stowed) position. Two detent ready positions hold the buggy top partially open for forward visibility. This affords the pilot partial protection in the event of a surprise burst and shortens the time required to go from the ready position to fully closed. Buggy top should stay in detented positions if subjected to turbulence or acceleration forces of 5 g or less.

OPERATION

To close the buggy top, reach back with either hand and pull forward on the right handhold to release the locking mechanism.

In cases when "hands on stick" flight is required the recommended procedure for unlatching the buggy top is to reach across the chest with the left arm while holding the stick with the right hand. Pull it forward to the ready position checking by feel to assure it centers in both detents simultaneously. To fully close the buggy top, firmly grasp the handholds with both hands and slam it shut to preclude the possibility of light leaks by seating the detents firmly on both sides. Pilots should gain proficiency in operation of the thermal radiation closure on short practice missions at safe altitudes. The closure may also be used as an instrument training hood.

To open, pull back on the handholds to override the detent pressure and telescope the closure back into its stowed and locked position.

WARNING

Ascertain that the closure locks in the stowed position to prevent its slamming shut inadvertently. This may be checked by pulling forward on the hood.

The pilot should familiarize himself with the operation of the thermal radiation closure prior to flight.

The following method is suggested:

1. Adjust seat to its lowest position.
2. Close and latch the canopy.
3. Check the accessibility of the face curtain handle.
4. Adjust seat upward exercising care not to strike enclosure.

NOTE

When the thermal radiation closure is installed, the alternate ejection handle is recommended for ejection.

5. Unlock buggy top and pull it forward to its detent ready position. Operation should be smooth and without binding. Even fingertip pressure on each handhold should assure buggy top is firmly held in both right- and left-detent positions. A pull of approximately 10 pounds is required to override the detent pressure.
6. Close buggy top by slamming firmly down using both handholds. Check for light leaks.

NOTE

In direct sunlight or equivalent there shall be no outside light directly visible to the pilot.

7. Check the accessibility of the face curtain handle.
8. Return buggy top to the open (stowed) position and check for positive latch.
9. Inspect all exposed surfaces of the thermal radiation closure for cleanliness.

EMERGENCY OPERATION

The thermal radiation closure will be jettisoned along with the canopy in emergencies. The extended aft portion of the glareshield is flexible and will deflect if contacted during ejection.

Antiexposure Suit Ventilation

An antiexposure suit ventilation control panel is installed on the left-hand console (figures FO-1 and FO-2) for use with the Mark 5 antiexposure suit.

JATO ARMING SWITCH

The JATO arming switch is a two-position lever-lock toggle switch labeled ARMED and OFF. To place the switch in the ARMED position, the spring-loaded toggle lever must be lifted. This arms the JATO firing circuit by energizing the JATO firing button on the catapult handgrip and the jettison circuit to the jettison switch.

JATO ARMED INDICATOR LIGHT

A JATO armed indicator light on the control panel comes on when the arming switch is energized. The press-to-test feature of this light provides a means for preflight checking of JATO arming and firing circuit continuity.

JATO JETTISON SWITCH

The JATO jettison switch on the control panel is a guarded, momentary-control toggle switch, spring-loaded to the SAFE position. In the JATO JETT position the switch energizes a solenoid-controlled hydraulic selector valve which directs hydraulic pressure to the JATO mounting hook actuating cylinders. The mounting hooks are actuated to release both JATO bottles simultaneously.

NEW

CAUTION

When JATO bottles are installed, operation of the emergency speedbrake control will force the JATO bottles off the aircraft resulting in airframe damage.

NEW

NOTE

An interlock in the speedbrake electrical circuit prevents normal operation of speedbrakes with JATO bottles attached. Be sure the speedbrake switch on the throttle is in the CLOSED position prior to jettisoning the JATO bottles; otherwise, upon release of the JATO bottles the speedbrakes will open.

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WARNING

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forms a glareshield extension. The buggy top pivots down and forms a light seal with the fixed panel completely sealing the pilot within a thermal protective covering. Attached to the forward segment of the buggy top are right and left handholds for opening and closing as required. The right handhold contains a latching mechanism for locking the buggy top in the open (stowed) position. Two detent ready positions hold the buggy top partially open for forward visibility. This affords the pilot partial protection in the event of a surprise burst and shortens the time required to go from the ready position to fully closed. Buggy top should stay in detented positions if subjected to turbulence or acceleration forces of 5 g or less.

OPERATION

To close the buggy top, reach back with either hand and pull forward on the right handhold to release the locking mechanism.

In cases when "hands on stick" flight is required the recommended procedure for unlatching the buggy top is to reach across the chest with the left arm while holding the stick with the right hand. Pull it forward to the ready position checking by feel to assure it centers in both detents simultaneously. To fully close the buggy top, firmly grasp the handholds with both hands and slam it shut to preclude the possibility of light leaks by seating the detents firmly on both sides. Pilots should gain proficiency in operation of the thermal radiation closure on short practice missions at safe altitudes. The closure may also be used as an instrument training hood.

To open, pull back on the handholds to override the detent pressure and telescope the closure back into its stowed and locked position.

WARNING

Ascertain that the closure locks in the stowed position to prevent its slamming shut inadvertently. This may be checked by pulling forward on the hood.

The pilot should familiarize himself with the operation of the thermal radiation closure prior to flight.

The following method is suggested:

1. Adjust seat to its lowest position.

2. Close and latch the canopy.

3. Check the accessibility of the face curtain handle.

4. Adjust seat upward exercising care not to strike enclosure.

NOTE

When the thermal radiation closure is installed, the alternate ejection handle is recommended for ejection.

5. Unlock buggy top and pull it forward to its detent ready position. Operation should be smooth and without binding. Even fingertip pressure on each handhold should assure buggy top is firmly held in both right- and left-detent positions. A pull of approximately 10 pounds is required to override the detent pressure.

6. Close buggy top by slamming firmly down using both handholds. Check for light leaks.

NOTE

In direct sunlight or equivalent there shall be no outside light directly visible to the pilot.

7. Check the accessibility of the face curtain handle.

8. Return buggy top to the open (stowed) position and check for positive latch.

9. Inspect all exposed surfaces of the thermal radiation closure for cleanliness.

EMERGENCY OPERATION

The thermal radiation closure will be jettisoned along with the canopy in emergencies. The extended aft portion of the glareshield is flexible and will deflect if contacted during ejection.

Antiexposure Suit Ventilation

An antiexposure suit ventilation control panel is installed on the left-hand console (figures FO-1 and FO-2) for use with the Mark 5 antiexposure suit.

The control panel contains the EXPOSURE SUIT VENT and OFF toggle switch, a ventilation blower, and a quick-disconnect flexible hose for connection to the antiexposure suit. The suit hose disconnect coupling contains a butterfly valve to control the flow of ventilating air to the antiexposure suit or to close off the opening when the suit is not used.

Map Pocket

A map pocket is provided on the right side of the cockpit.

Spare Lamps Receptacle

Replacement lamps are contained in the SPARE LAMPS receptacle (figures FO-1 and FO-2) on the right-hand console.

Rear View Mirrors

A rear view mirror is installed on each side of the canopy bow and provides limited rearward vision during flight and taxiing.

PART 3
AIRCRAFT SERVICING

GENERAL

The following part describes the minimum servicing information the pilot should know. NAVAIR 01-40AVC-2-1 contains a complete description of all servicing procedures.

PRESSURE FUELING

Normal Pressure Fueling of Aircraft and External Fuel Tanks

(See figures 1-27 and 1-28.)

WARNING

- Follow procedure only when external electrical power is available and more than 100 gallons of fuel is to be delivered. Use alternate method when external electrical power is not available. Use top-off method if adding less than 100 gallons of fuel.
- Make certain that fuel vent is not obstructed.
- Ensure that aircraft and pressure fueling equipment are properly grounded.
- All maintenance on aircraft must stop during pressure fueling; adequate fire fighting equipment must be available in immediate area.
- Do not start fueling operations within 100 feet of aircraft with radar equipment being operated.

NOTE

- Aircraft should be in 6-degree noseup attitude during pressure fueling to allow maximum amount of fuel to enter aircraft tanks.
- Recommended flow rate from pressure fueler is 200 gallons per minute at 18 psi.

PROCEDURE

1. Open engine aft compartment access door.

2. Remove pressure fueling-defueling receptacle valve cap.

3. Connect pressure fueling nozzle to pressure fueling-defueling receptacle valve.

NOTE

When the nozzle is connected to the valve, the aircraft is grounded automatically through the connection and no further grounding of individual fuel tanks is necessary.

4. On switch adjacent to receptacle valve, check DROP TANK FUELING switch OFF.

WARNING

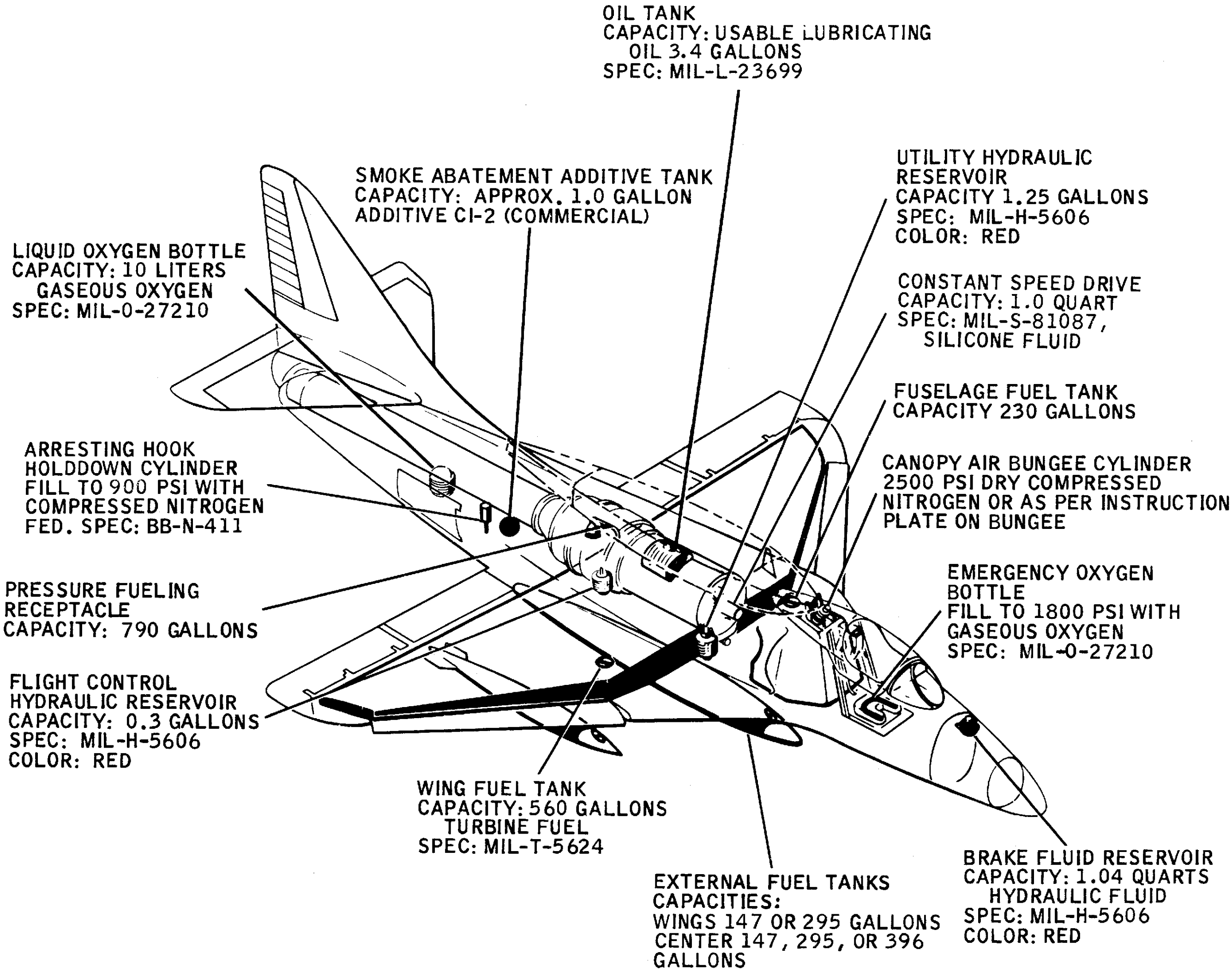
Proper connection of ac external power cable plug to aircraft external power receptacle must be made. Failure to insert plug completely in receptacle can result in presence of high voltage on aircraft metal surfaces.

5. Connect external electrical power to aircraft.

NOTE

Two methods of applying external ac power are possible. The first method utilizes the ground start and refueling adapter cable, which permits ac power to be applied through the engine starter access door. The second method is performed by applying ac power through the external power receptacle. (Refer to External Power Application, this section.)

6. Energize external electrical power



NOTE:

FUEL TANK CAPACITIES BASED ON USABLE FUEL AND PRESSURE FUELING.

FUEL SPECIFICATIONS	
APPROVED FUEL	
ASHORE	AFLOAT
JP-4 JP-5	JP-5

TANKS	US GAL.	IMP GAL.	LITERS
FUSELAGE FUEL CELL	230	191.5	870.5
WING INTEGRAL FUEL TANK	560	466.2	2119.6
EXTERNAL FUEL TANK, AERO 1C	147	122.3	556.3
EXTERNAL FUEL TANK, AERO 1C	295	245.6	1116.8
EXTERNAL FUEL TANK, AERO 1D	295	245.6	1116.5
AIR REFUELING STORE	295	245.6	1116.5
EXTERNAL FUEL TANK, (400 GALLONS)	396	329.7	1498.8

GG1-28-A

Figure 1-27. Servicing Diagram

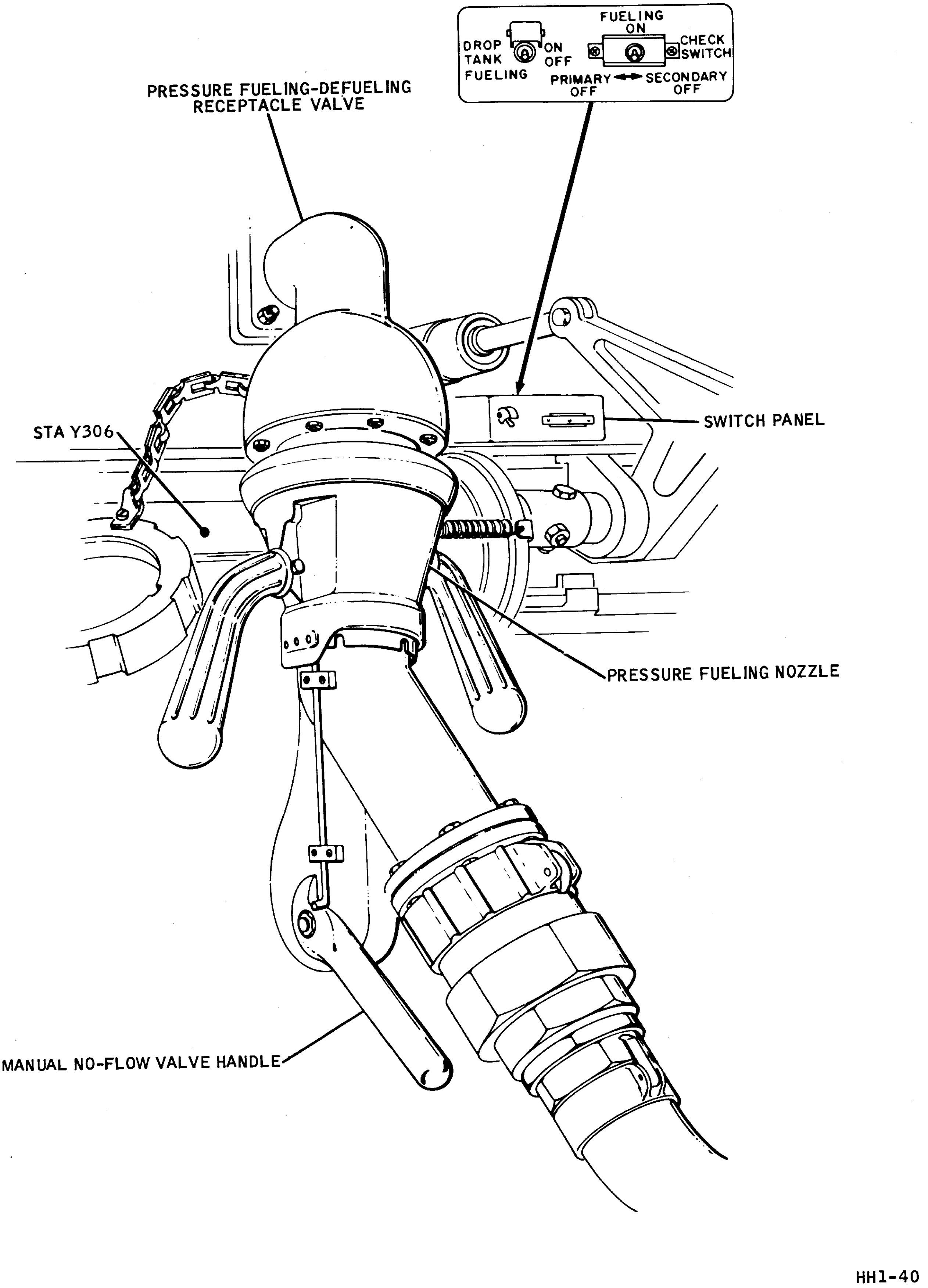


Figure 1-28. Pressure Fueling Aircraft and External Fuel Tanks

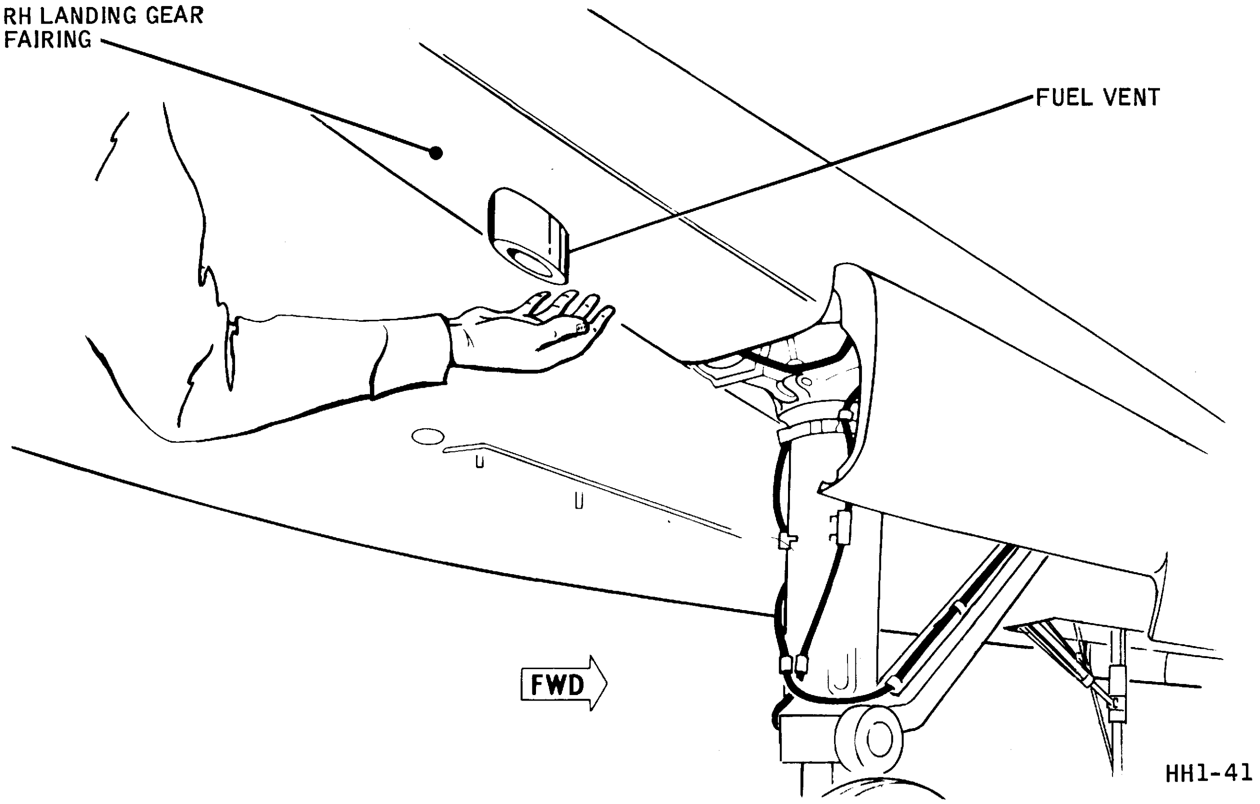


Figure 1-29. Fuel Vent System Outlet Mast

7. Open manual no-flow valve on fueling nozzle and commence pressure fueling.

CAUTION

Maximum no-flow pressure must not exceed 55 psi at any time at fueling nozzle.

8. Immediately after pressure fueling has started, test the fuel vent system for proper functioning by holding the hand beneath fuel vent mast at the right-hand main gear fairing (figure 1-29).

CAUTION

Air should be exhausted from fuel vent mast during pressure fueling. If air cannot be felt exhausting from the mast, stop pressure fueling operations immediately and investigate fuel vent system.

9. During the initial stage of pressure fueling operations, perform functional test of pressure fueling shutoff components by actuating switches on switch panel as follows:

CAUTION

If fuel flow does not stop when noted in following test, stop pressure fueling operations immediately and investigate. Replace any defective component.

NOTE

When it is specified that fuel flow should stop during following test, an apparent leakage of 2 gpm maximum is permissible registered on pressure fueling meter. Leakage is due to flow of fuel through pilot lines of float valves. When pressure fueling is completed (all tanks full) leakage must not exceed 1 gpm.

10. Place CHECK SWITCH in PRIMARY OFF position. Fuel flow should stop in 1 to 3 seconds.

11. With DROP TANK FUELING switch remaining in OFF position, place CHECK SWITCH in FUELING ON position. Fuel flow should resume.

12. Place CHECK SWITCH in SECONDARY OFF position. Fuel flow should stop in 1 to 3 seconds.

13. Hold CHECK SWITCH in SECONDARY OFF position, and place DROP TANK FUELING switch in ON position. Fuel flow should start into external fuel tanks only. Place DROP TANK FUELING switch in OFF unless drop tanks are to be filled.

14. Place CHECK SWITCH in FUELING ON position. Fuel flow should start into wing integral fuel tank and fuselage fuel cell; fuel flow should continue into external fuel tanks if DROP TANK FUELING switch is ON.

NOTE

During pressure fueling, drop tanks may fill unevenly.

15. Continue pressure fueling.

16. During pressure fueling, inspect for evidence of fuel leakage. Correct if required.

17. When pressure fueling has been completed, place DROP TANK FUELING switch in OFF position.

18. Close manual no-flow valve on fueling nozzle.

19. Disconnect nozzle from nozzle receptacle valve.

20. Install receptacle valve cap.

21. Disconnect external electrical power from aircraft.

22. Close engine aft compartment access door.

Pressure Fueling — Top-Off Method

Top-off procedure is used when less than 100 gallons of fuel is required to complete filling of tanks and when external electrical power is available. The alternate method outlined in this section must be used when external electrical power is not available. Because of the short time required to pressure fuel less than 100 gallons, strict adherence to all steps is mandatory to prevent possible rupture of the wing integral tank. The procedure is as follows:

CAUTION

- Stop all maintenance on aircraft during fueling operation.
- Ensure that adequate fire fighting equipment is available in immediate area.
- Do not fuel aircraft within 100 feet of aircraft with radar equipment being operated.
- Make certain that fuel vent mast is not obstructed.
- Do not start fueling operations within 100 feet of aircraft with radar equipment being operated.

1. Open aft engine compartment access door.

2. Remove pressure fueling-defueling receptacle valve cap.

3. Remove fuselage fuel cell and wing integral tank gravity filler caps.

4. Connect pressure fueling nozzle to receptacle valve.

NOTE

When the pressure fueling nozzle is connected to the valve, the aircraft is grounded automatically through the connection and no further grounding of individual fuel tanks is necessary.

WARNING

Proper connection of ac external power cable plug to aircraft external power receptacle must be made. Failure to insert plug completely in receptacle can result in presence of high voltage on aircraft metal surfaces.

5. Connect external electrical power to aircraft.

6. Energize external electrical power.

7. Place and hold CHECK SWITCH, on switch panel adjacent to receptacle valve, in PRIMARY OFF position.

8. Open manual no-flow valve on fueling nozzle and observe fuel supply meter for 1 minute. Fuel flow must not be indicated; maximum allowable leakage is 2 gpm.

9. Place CHECK SWITCH in FUELING ON position for 2 to 3 seconds. Fuel supply meter must indicate normal fuel flow.

CAUTION

Maximum no-flow pressure at fueling nozzle must not exceed 55 psig.

10. Place and hold CHECK SWITCH in SECONDARY OFF position. Fuel flow must cease within 5 seconds. Observe fuel supply meter; maximum allowable leakage is 2 gpm.

CAUTION

If valves fail to function properly, stop fueling immediately and investigate.

11. If surveillance check indicates satisfactory valve operation, place CHECK SWITCH in FUELING ON position and resume fueling. If drop tanks are to be topped off place DROP TANK FUELING switch in ON.

12. When topping-off is completed, close no-flow valve on fueling nozzle and disconnect nozzle from receptacle.

13. Verify that DROP TANK FUELING switch is OFF.

14. Install receptacle valve cap.

15. Disconnect external electrical power from aircraft.

16. Install fuselage fuel cell and wing integral tank gravity filler caps.

17. Close engine aft compartment access door.

Pressure Fueling — Alternate Method

External fuel tanks cannot be pressure fueled using the alternate procedure. The following procedure is used when external electrical power is not available. Because of the short time required to pressure fuel less than 100 gallons, strict adherence to all steps is mandatory to prevent possible rupture of the wing integral tank.

CAUTION

- Aircraft and pressure fueling equipment must be properly grounded during pressure fueling.
- All maintenance on aircraft must stop during pressure fueling.
- Adequate fire fighting equipment must be available in immediate area.
- Make certain that fuel vent mast is not obstructed.
- Do not start fueling operations within 100 feet of aircraft with radar equipment being operated.

1. Open engine aft compartment access door.

2. Remove pressure fueling-defueling receptacle valve cap.

3. Remove fuselage fuel cell gravity filler cap.

4. Remove wing integral fuel tank gravity filler cap.

CAUTION

Gravity filler caps must be removed as instructed in steps 3 and 4 to prevent possible damage to wing integral fuel tank structure.

5. Connect pressure fueling nozzle to pressure fueling-defueling receptacle valve.

NOTE

When the pressure fueling nozzle is connected to the valve, the aircraft is grounded through the connection and no further grounding of individual fuel tanks is necessary.

6. Open manual no-flow valve on fueling nozzle and commence pressure fueling.

CAUTION

One man should stand ready to stop pressure fueling equipment immediately should any pressure fueling shutoff component fail to stop fuel flow when tanks are full. This will be manifested by fuel flow from the filler ports.

7. During pressure fueling, inspect for evidence of fuel leakage. Also inspect fuel vent mast and external fuel tank overboard vent line for evidence of fuel leakage. Correct if leakage is evident.

8. When pressure fueling has been completed, close manual no-flow valve on fueling nozzle and disconnect nozzle from receptacle valve.

9. Verify that DROP TANK FUELING switch is OFF.

10. Install receptacle valve cap.

11. Install fuselage fuel cell gravity filler cap.

12. Install wing tank gravity filler cap.

13. Close or reinstall aft engine compartment access door.

HOT REFUELING

Refer to procedures in section III, part 5, for refueling of aircraft with the engine running.

GRAVITY FUELING

CAUTION

- Ground aircraft and fueling equipment during all fueling operations.
- Stop all maintenance on aircraft during fueling.
- Ensure that adequate fire fighting equipment is available in immediate area.
- Make certain that proper fuel is used for refueling. (Refer to servicing diagram.)
- Do not connect external electrical power to aircraft when gravity fueling.
- Do not start fueling or defueling operations within 100 feet of aircraft operating with radar equipment.

Gravity Fueling Fuselage Fuel Cell

(See figure 1-30.)

1. Open fuselage cell gravity filler access door, remove cap from gravity filler port.

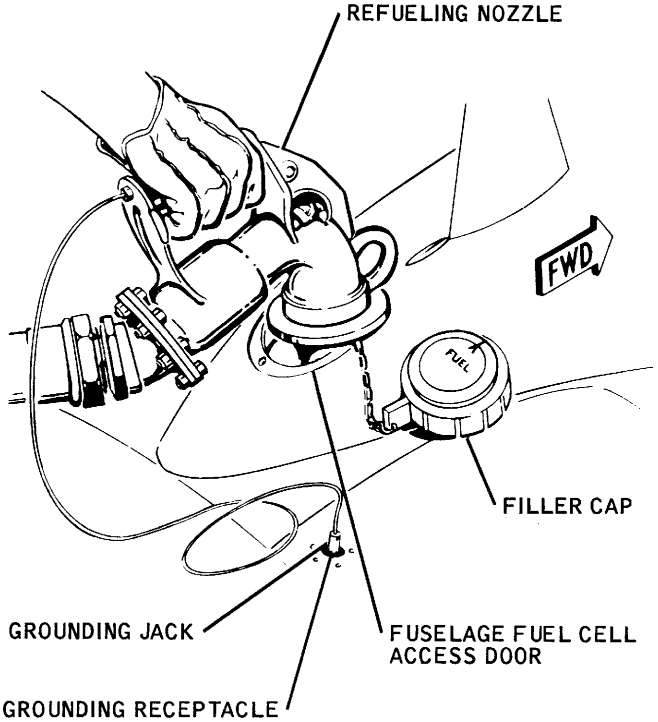


Figure 1-30. Gravity Fueling Fuselage Fuel Cell

2. Insert nozzle grounding jack in grounding receptacle directly aft and outboard of access door; insert refueling nozzle in gravity filler port.

3. Fill fuselage cell until fuel level is at bottom of gravity filler port neck.

4. Remove refueling nozzle from gravity filler port; disconnect grounding jack from receptacle.

5. Install gravity filler port cap and secure access door.

Gravity Fueling Wing Integral Fuel Tank

(See figure 1-31.)

1. Remove wing integral fuel tank filler cap.

2. Insert refueling nozzle grounding jack in grounding receptacle on wing nose.

CAUTION

- Do not drop fueling nozzle in wing tank filler port since nozzle will damage lower surface of tank.
- Do not pull fueling hose over wing slats.

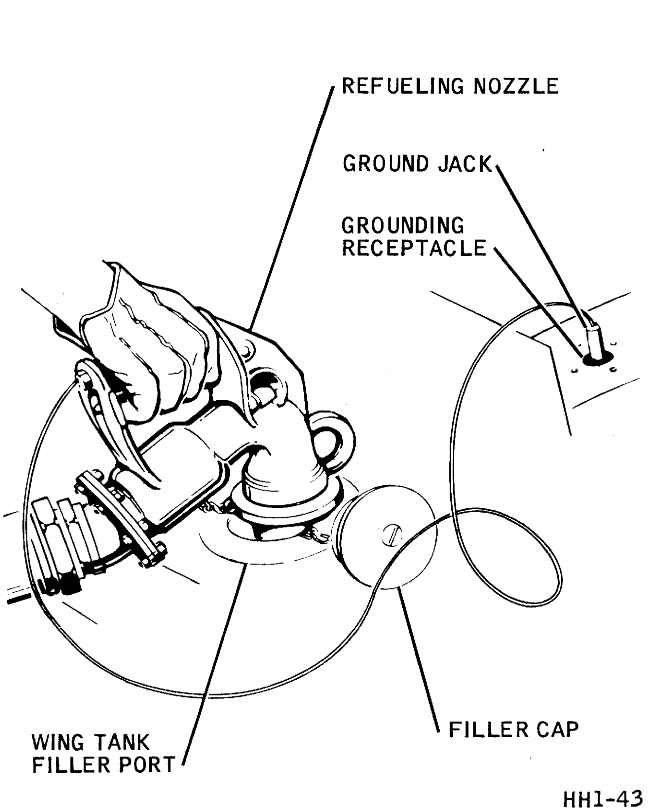


Figure 1-31. Gravity Fueling Wing Integral Tank

3. Insert refueling nozzle in gravity filler port. Hold refueling nozzle in one hand and support refueling hose with other hand.

4. Fill wing fuel tank until fuel is at bottom of gravity filler port neck.

5. Remove refueling nozzle from gravity filler port; disconnect grounding jack from receptacle.

6. Install wing fuel tank gravity filler port cap and lock securely in place.

Gravity Fueling External Fuel Tank or Air Refueling Store

(See figure 1-32.)

1. Remove tank or store filler cap.

2. Insert refueling nozzle grounding jack in grounding receptacle on left-hand side of external stores rack.

3. Insert refueling nozzle into filler port. Hold refueling nozzle in one hand and support refueling hose with other hand.

4. Fill tank or store until fuel level is approximately 1 inch below filler port to allow for thermal expansion.

5. Remove refueling nozzle from filler port; disconnect refueling nozzle grounding jack from receptacle.

6. Install tank or store filler cap.

FUEL CONTROL FUEL SELECTOR

The fuel grade selector on the engine fuel control should correspond to the grade of fuel being used. After JP-4 is introduced into the fuel system of the engine, the specific gravity switch on the fuel control will be set to JP-4. The setting will not be returned to JP-5 until after the first flight during which JP-5 has been used. (See figure 1-33.)

Adjustment

1. Open engine forward compartment left-hand access door.

2. Remove retaining nut securing locking bracket to retaining stud on housing.

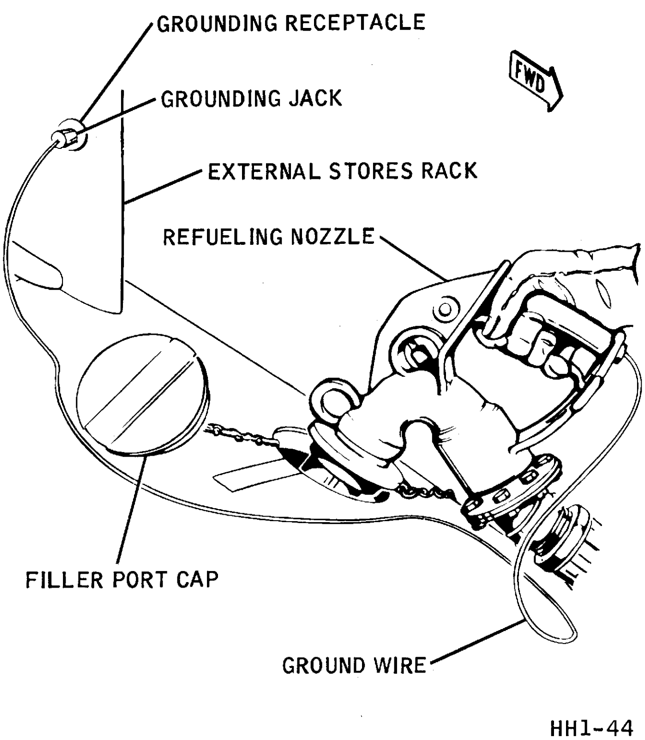


Figure 1-32. Gravity Fueling External Fuel Tank or Air Refueling Store

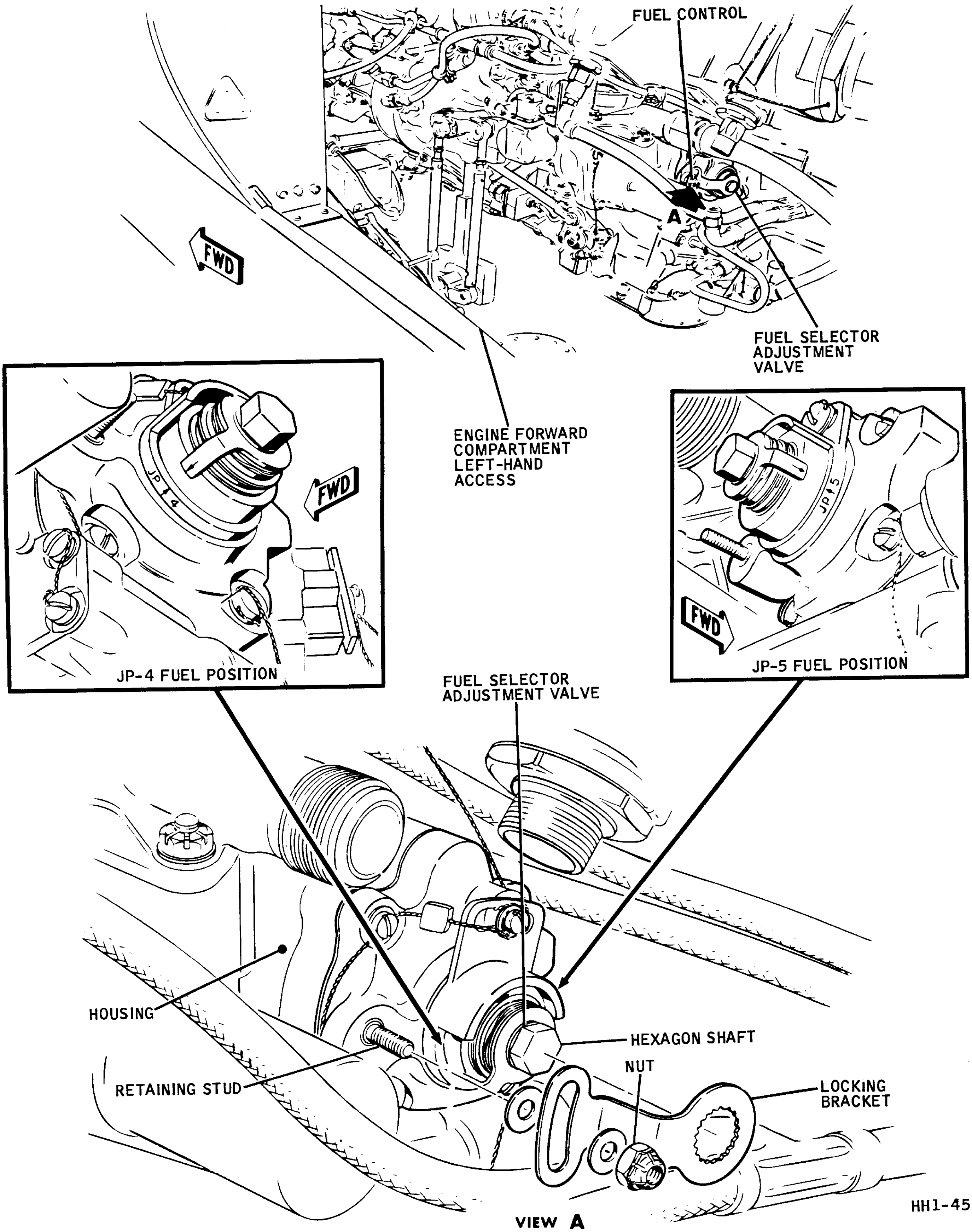


Figure 1-33. Fuel Control Fuel Selector Adjustment

3. Remove locking bracket from stud.

4. Invert locking bracket and insert over hexagon shaft.

5. Using locking bracket as a wrench, rotate hexagon shaft until pointer on outside of valve is aligned with index for grade of fuel to be used.

6. Replace locking bracket over hexagon shaft so that slotted end fits over retaining stud on housing.

7. Secure bracket to retaining stud with washer and nut.

8. Close engine forward compartment left-hand access door.

ENGINE EXHAUST SMOKE ABATEMENT SYSTEM SERVICING

Effectivity: All aircraft reworked per A-4 AFC 382

WARNING

The smoke abatement additive (C1-2) used for servicing this system is toxic. Make certain that Maintenance Safety Precautions are observed. (Refer to NAVAIR 01-40AVC-2-1.)

(See figure 1-34.)

1. Open aft fuselage lower access door.

2. Remove dust cap from additive tank overflow vent coupling and from coupling on hose attached to plastic overflow bottle on cart. Attach overflow bottle hose coupling to overflow vent coupling.

3. Remove dust cap from additive fill coupling on aircraft and from coupling on fill hose attached to back of cart. Connect coupling on fill hose to aircraft fill coupling.

4. Reset meter dial on front of cart to zero (turn dial counterclockwise).

5. Actuate cart pump handle until additive overflows into plastic bottle.

6. Disconnect vent and fill couplings and replace dust caps.

7. Close aft fuselage lower access door.

CAUTION

If deck or airfield temperatures lower than 28°F (-2.2°C) are anticipated, the smoke abatement additive tank and associated tube assemblies must be drained to prevent freezing and possible rupture of system components. Refer to NAVAIR 01-40AVC-2-1 for draining procedures.

ENGINE OIL SYSTEM SERVICING

Servicing provisions are accessible through the engine compartment lower access doors. The PON-5A pressure oiling unit is recommended for servicing the engine oil tank.

ENGINE OIL SYSTEM QUANTITY CHECK

Checking or filling the engine oil system shall be accomplished at engine shutdown or not over 30 minutes after engine shutdown with external electrical supply. NEW

NOTE

When electrical power is applied to the aircraft several hours after shutdown, the oil low level warning light will come on. The oil drains from the engine into the gearbox. Engine operation will pump the oil back to the tank. Engine must be turned up 75 percent rpm or more for 8 minutes to establish actual oil tank level.

1. Apply external power to aircraft (figure 1-49).

2. Press MASTER PRESS-TO-TEST switch to ensure indicator lights are operative, and release switch.

3. If oil low level warning light remains on, system is below 20 percent remaining level. This indicates dangerously low oil state, and engine oil tank must be serviced.

4. The warning light comes on when pressed if the oil level is below the 80 percent level. Service is required.

5. No light indicates a sufficient engine oil supply.

6. Remove external electrical power from aircraft.

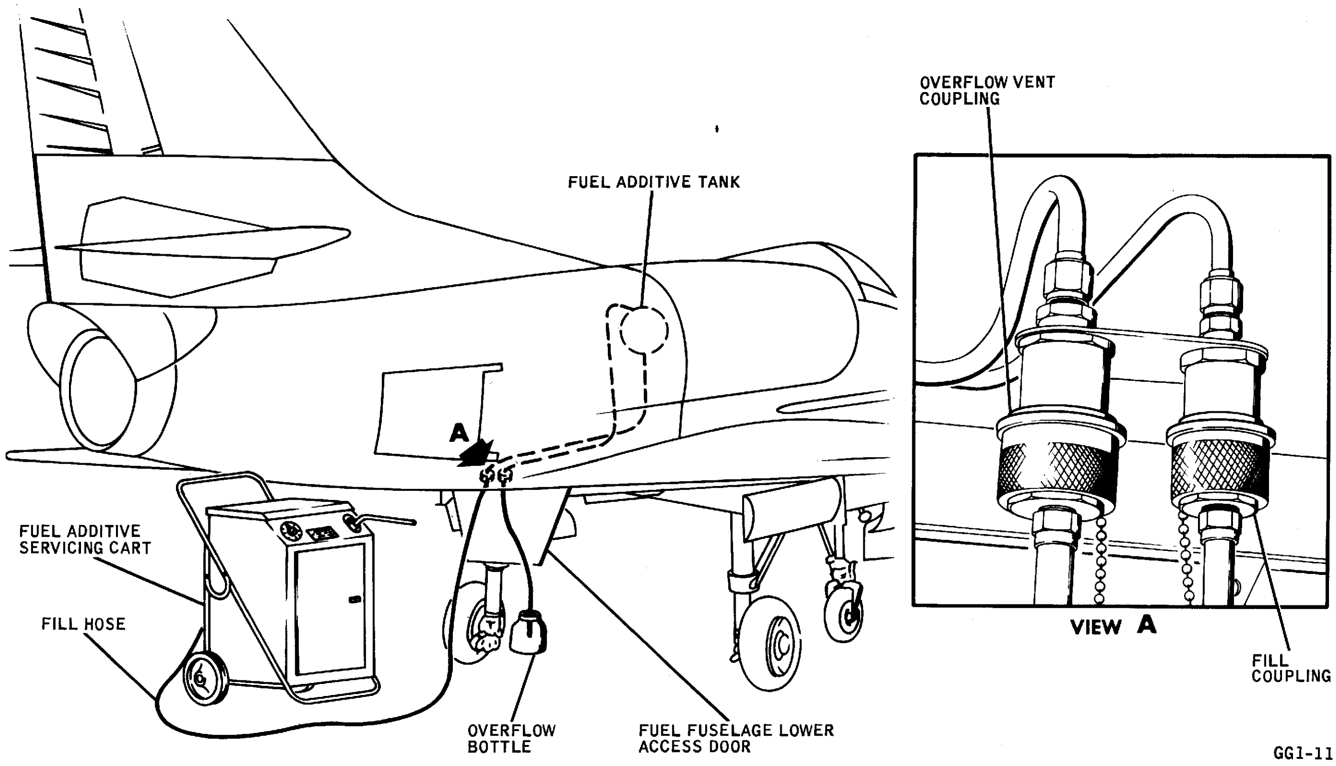


Figure 1-34. Engine Exhaust Smoke Abatement System – Pressure Filling

Engine Oil System Pressure Filling

(See figure 1-35.)

1. Remove oil fill and oil bleed dust caps.

2. Connect pressure oiling unit hose to fill connection.

3. Connect 3-foot hose with Roylyn 7776 3/4-inch (MS24475-2) quick-disconnect fitting to bleed connection.

NOTE

Bleed hose should be not more than 3 feet in length to prevent back pressure in bleed line.

4. Allow bleed hose to empty into open container.

5. Pump oil (MIL-L-23699) into tank until a continuous stream of oil runs out the bleed line.

CONSTANT SPEED DRIVE (CSD) SERVICING

The constant speed drive (figure 1-36) is located on the forward end of the engine. It is mounted on an adapter bolted to the engine pad and secured by a V-band coupling. The drive unit and components should be inspected daily. Access to the constant speed drive is through the engine forward compartment lower right-hand access door and the constant speed drive outer and inner access doors. Servicing consists of inspecting for fluid level and adding fluid.

Daily Inspection

The following inspection should be made:

1. Open engine forward compartment right-hand access door and constant speed drive outer and inner access doors.

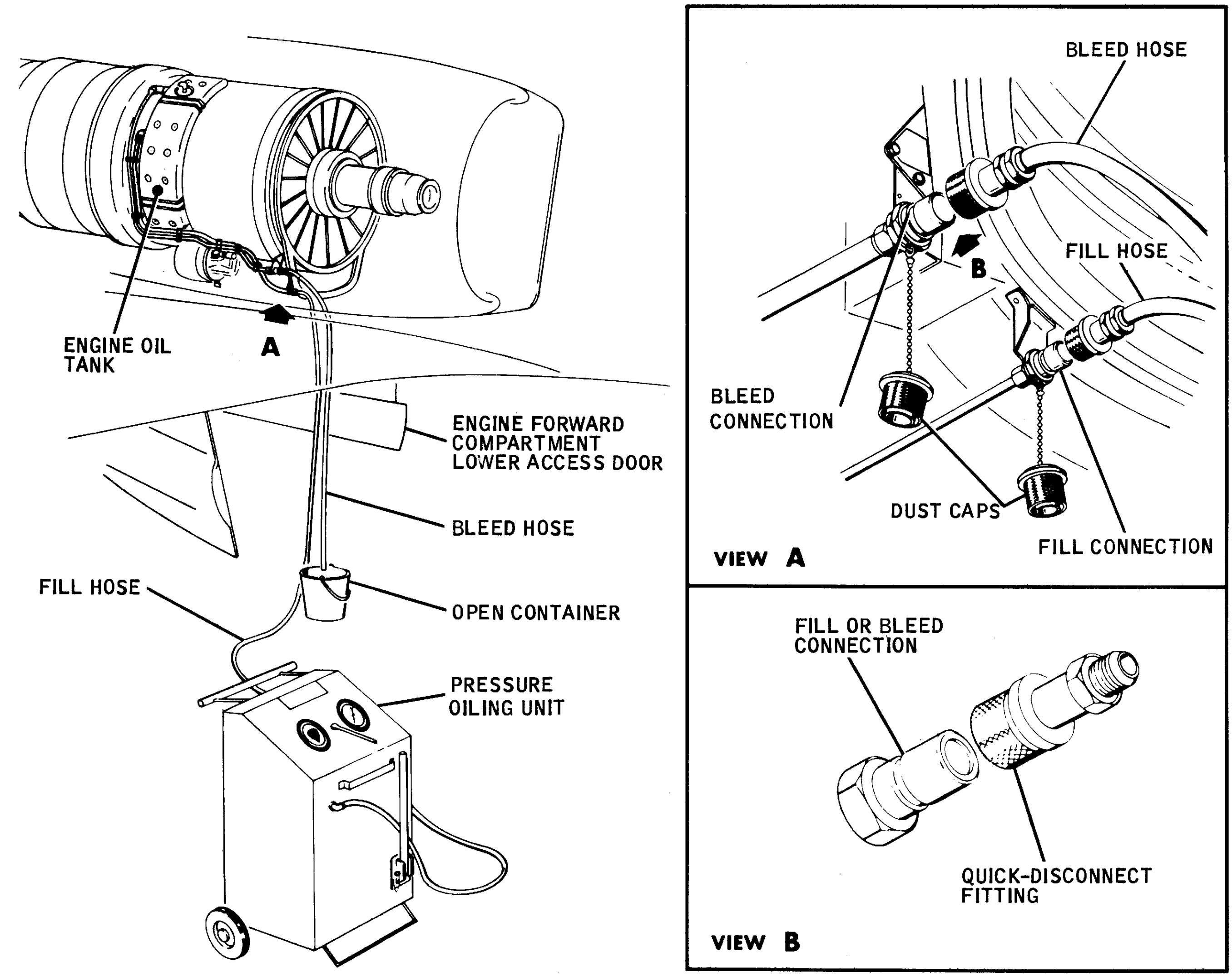


Figure 1-35. Engine Oil System – Pressure Filling

2. Using a flashlight and an inspection mirror, inspect constant speed drive for signs of fluid leakage.

3. Inspect fluid level on sight gage.

Filling

(See figure 1-36.)

1. Open engine forward compartment right-hand access door, and constant speed drive outer and inner doors.

2. Remove lockwire and filler plug located at top right-hand side of pump.

CAUTION

Use only MIL-S-81087, Type 1 fluid. Mixing or the use of other than an approved fluid will cause constant speed drive failure.

3. Use fluid MIL-S-81087, Type 1 until fluid level is at FULL mark on sight gage.

NOTE

The capacity of the constant speed drive is 1 quart.

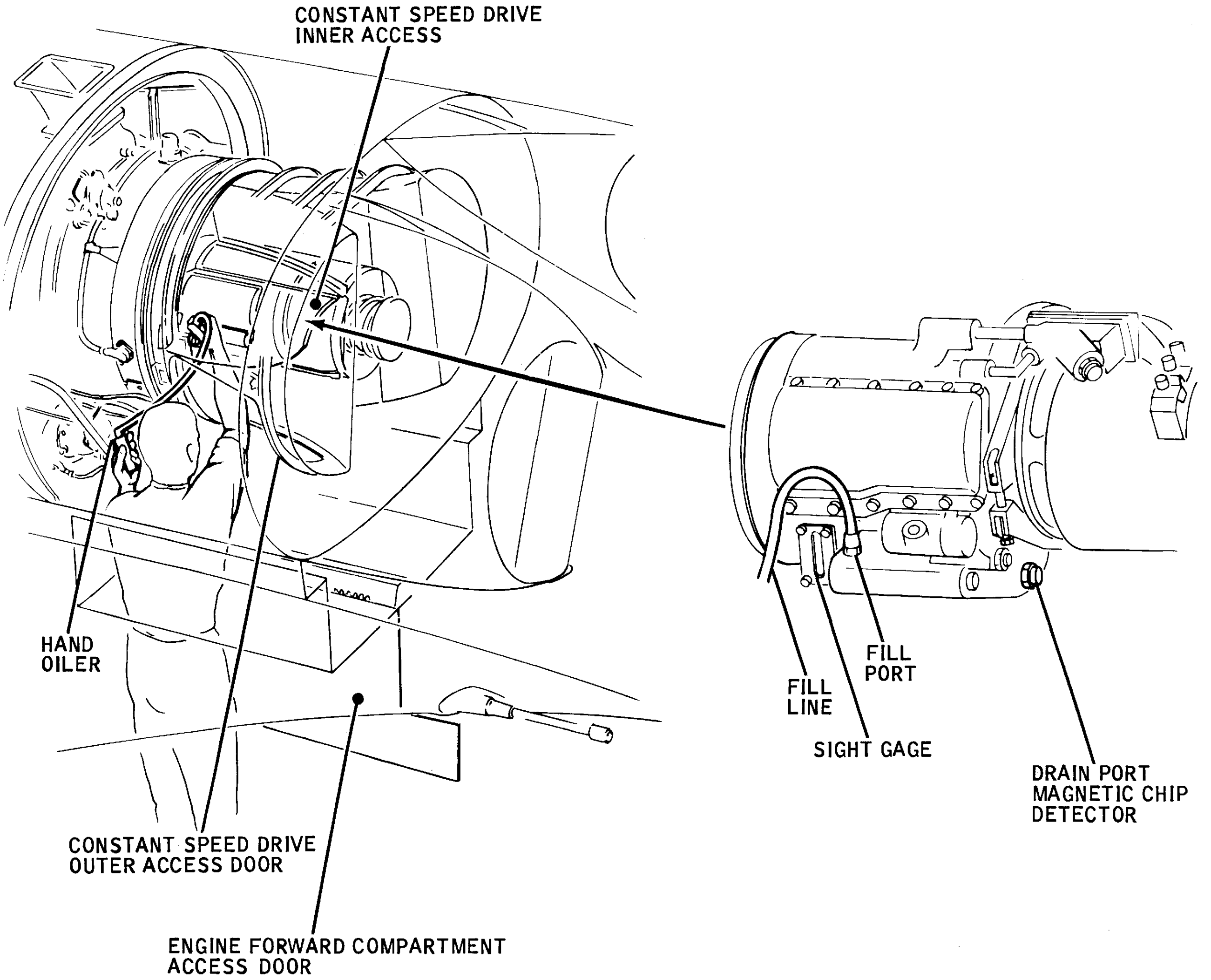


Figure 1-36. Constant Speed Drive Filling

4. Replace filler plug and secure with lockwire.

5. Replace access doors.

HYDRAULIC SYSTEM SERVICING

The utility hydraulic system and the flight control hydraulic system are serviced separately.

Utility Hydraulic System Filling

(See figure 1-37.)

1. Open engine forward compartment access doors and utility hydraulic reservoir access door.

2. Remove dust caps and connect source of hydraulic fluid to FILL quick-disconnect on right-hand side of engine compartment (figure 1-37).

3. Remove utility hydraulic bleed line from retaining clips; pass free end of line through utility hydraulic reservoir access door and place end in

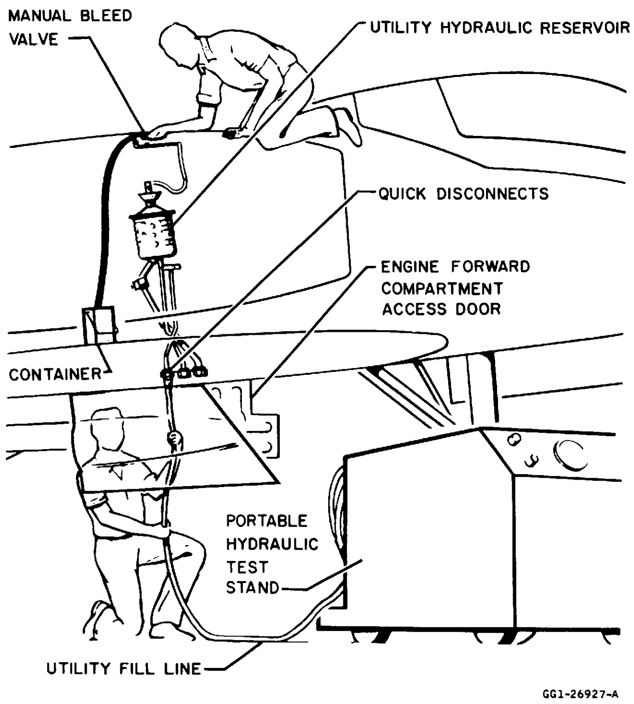


Figure 1-37. Utility Hydraulic System Filling

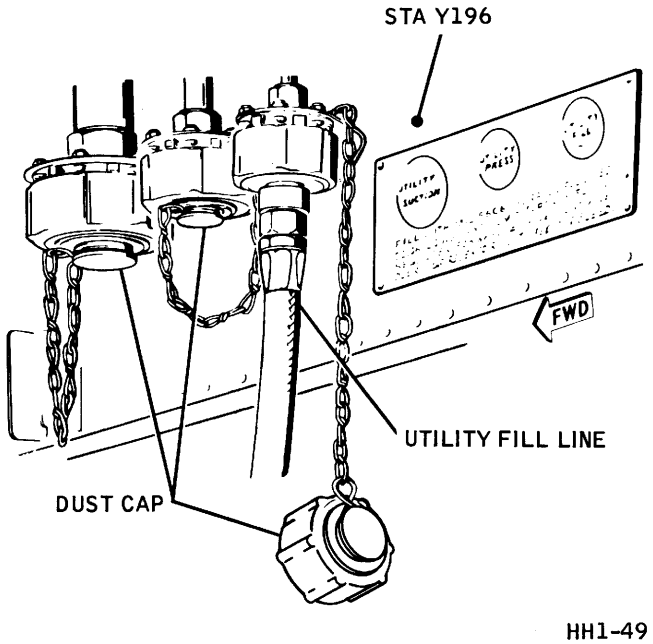


Figure 1-38. Utility Hydraulic Quick-Disconnect

suitable container on wing to receive any possible overflow of fluid when bleeding.

4. Fill reservoir until piston registers FULL on sight gage. (Gage is viewed through utility hydraulic reservoir access door.) (See figure 1-39.)

CAUTION

Do not allow pressure applied to FILL port to exceed 65 psi.

5. Depress manual bleed valve until sight gage is free of air bubbles. (See figure 1-40.)

6. Disconnect external supply source when reservoir has been filled and bled.

7. Install dust cap on FILL quick-disconnect.

8. Reinstall bleed line in retaining clips.

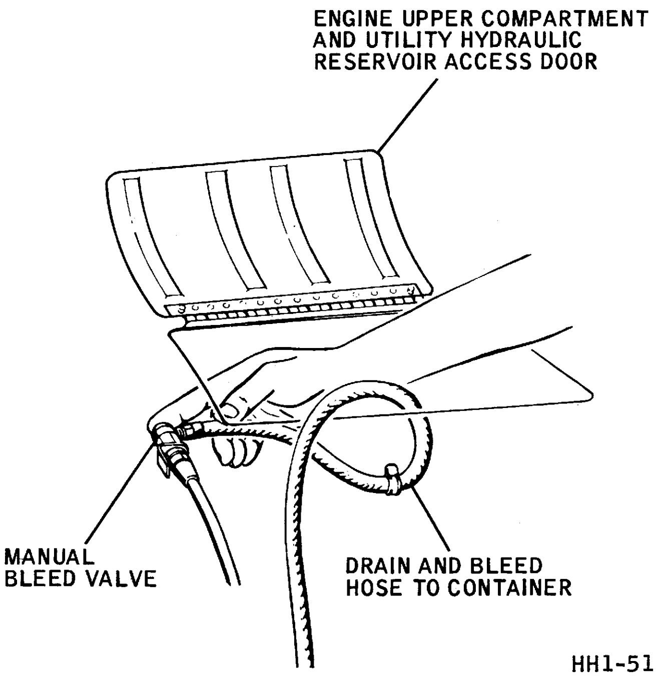


Figure 1-39. Utility Hydraulic Manual Bleed Valve

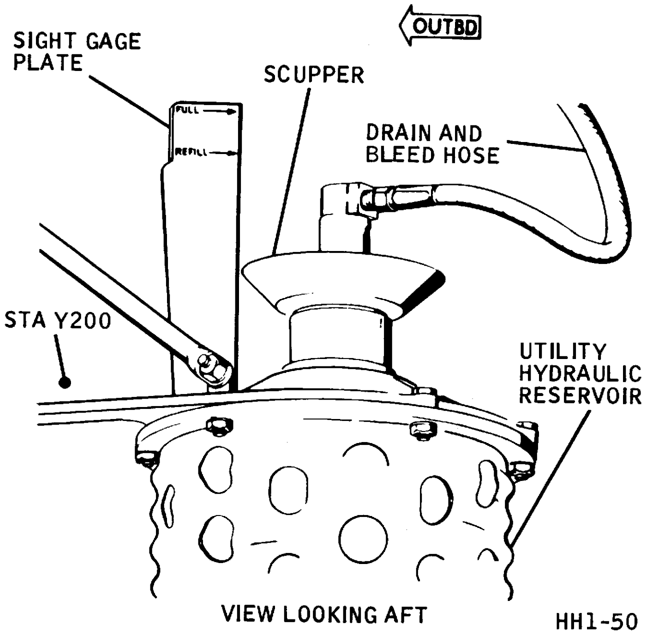


Figure 1-40. Utility Hydraulic Reservoir Sight Gage

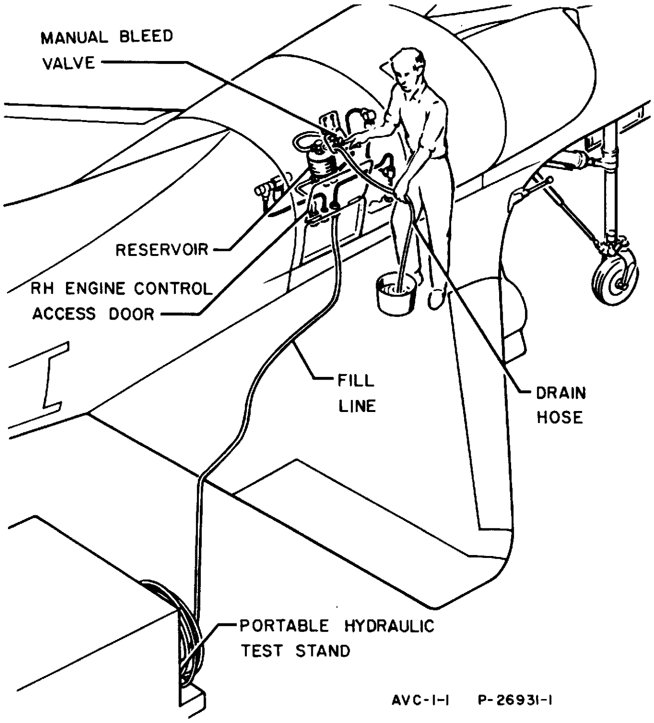


Figure 1-41. Flight Control Hydraulic System Filling

Flight Control Hydraulic System Filling

(See figure 1-41.)

1. Open engine control access door and flight control hydraulic reservoir access door.

NEW

2. Remove dust cap and connect source of hydraulic fluid (MIL-H-5606) supply to FILL quick-disconnect (figure 1-42).

3. Remove flight control hydraulic bleed line from retaining clip, pass free end of line through flight control hydraulic reservoir access door, and place free end in suitable container on wing to receive any possible overflow of fluid when bleeding (figure 1-43).

4. Fill reservoir until piston registers full on sight gage. (Gage is viewed through flight control hydraulic reservoir access door.) (See figure 1-44.)

CAUTION

Do not allow pressure applied to FILL port to exceed 100 psi.

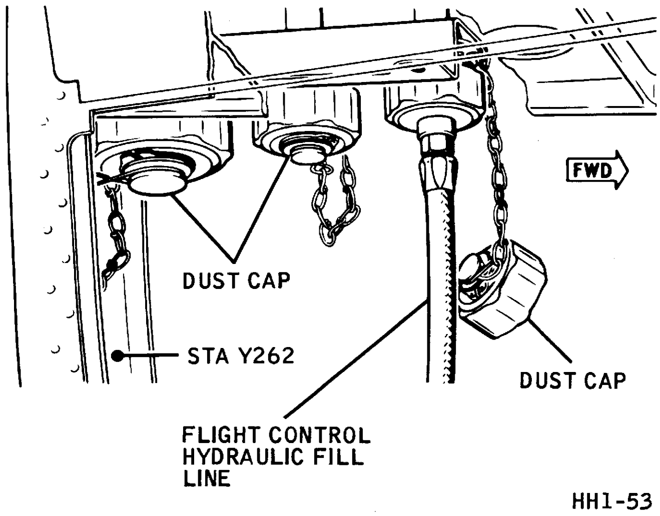


Figure 1-42. Flight Control Hydraulic Quick-Disconnect Panel

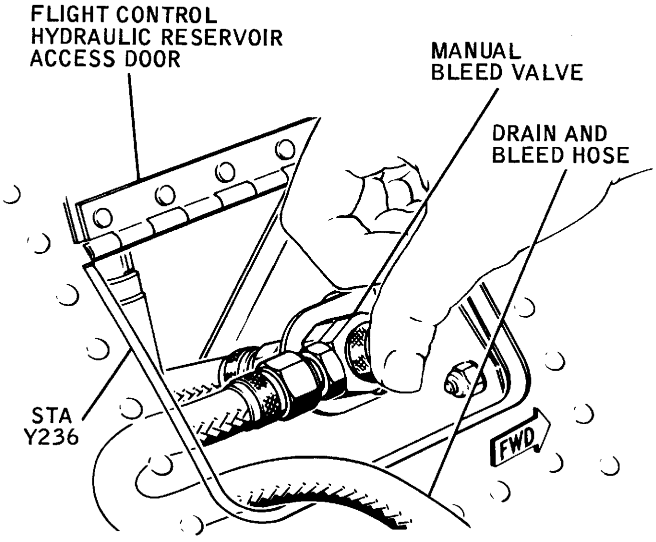


Figure 1-43. Flight Control Hydraulic Manual Bleed Valve

5. Depress manual bleed valve until sight gage is free of air bubbles.

6. Disconnect external supply source when reservoir has been filled and bled. Install dust cap.

7. Reinstall bleed line in retaining clamps; secure engine fuel control and flight control hydraulic reservoir doors.

Brake Reservoir Servicing

(See figure 1-45.)

1. Open nose section.

NOTE

Aircraft should be in a 6-degree noseup attitude for servicing.

2. Remove filler plug from brake reservoir.

3. Insert filler nozzle of hydraulic servicing tank into reservoir filler port.

4. Fill reservoir with hydraulic fluid until gage indicates full.

NOTE

When sight gage indicates reservoir is full, do not add more fluid; if reservoir is filled to level of port, excess fluid will be vented overboard during flight maneuvers.

5. Install reservoir filler plug.

NOTE

Clean any spilled hydraulic fluid by wiping area with cloth moistened in naptha.

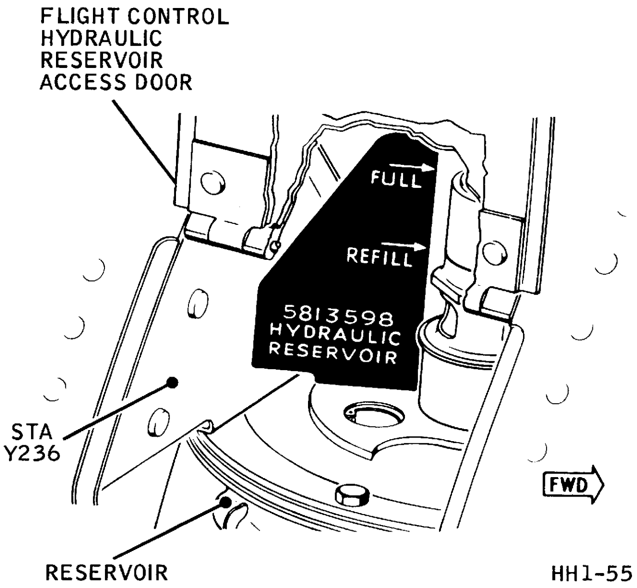
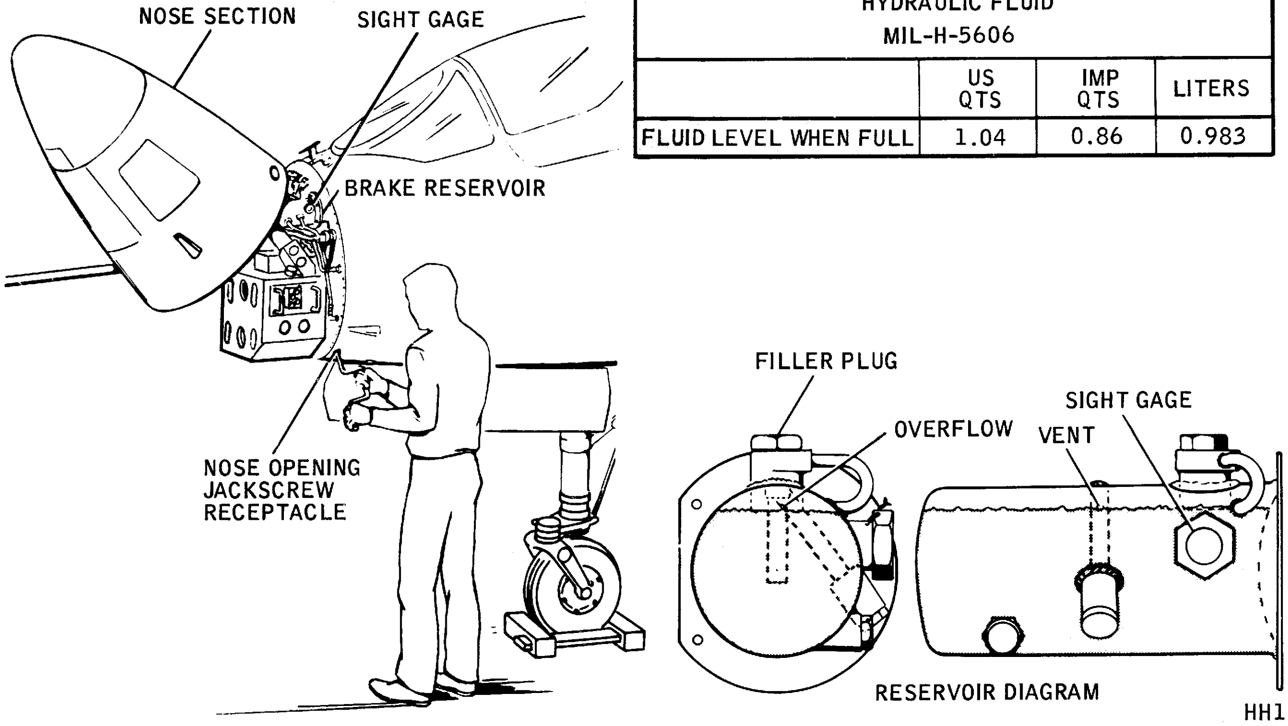


Figure 1-44. Flight Control Hydraulic Reservoir Sight Gage



HYDRAULIC FLUID MIL-H-5606			
	US QTS	IMP QTS	LITERS
FLUID LEVEL WHEN FULL	1.04	0.86	0.983

Figure 1-45. Brake Reservoir Servicing

6. Check brakes and bleed if necessary. (Refer to NAVAIR 01-40AVC-2-1.)

NOTE

If brakes are bled, service reservoir as necessary.

7. Close nose section.

RAIN REPELLENT SYSTEM SERVICING

Servicing the rain repellent system (figure 1-45A) consists of removal and replacement of the fluid container with a filled and charged container. A visual inspection of the system gage must be made during postflight inspection. If the gage indicates half full or less, the container should be replaced. Visual access to the system gage is gained through the AN/APX-64(V) coder access door.

Removal and Replacement of Fluid Container

WARNING

Make certain that aircraft ground handling safety equipment, referred to in NAVAIR 01-40AVC-2-1, is installed and that no electrical power is connected to the aircraft while servicing this system. Failure to comply may result in injury to personnel.

1. Open nose section of aircraft.

2. Loosen thumbscrew on clamp that holds container in support assembly.

3. Unscrew container from manifold.

NOTE

Some loss of fluid may occur during step 3 because of the residual pressure and fluid in the container. Catch residual fluid with a cloth.

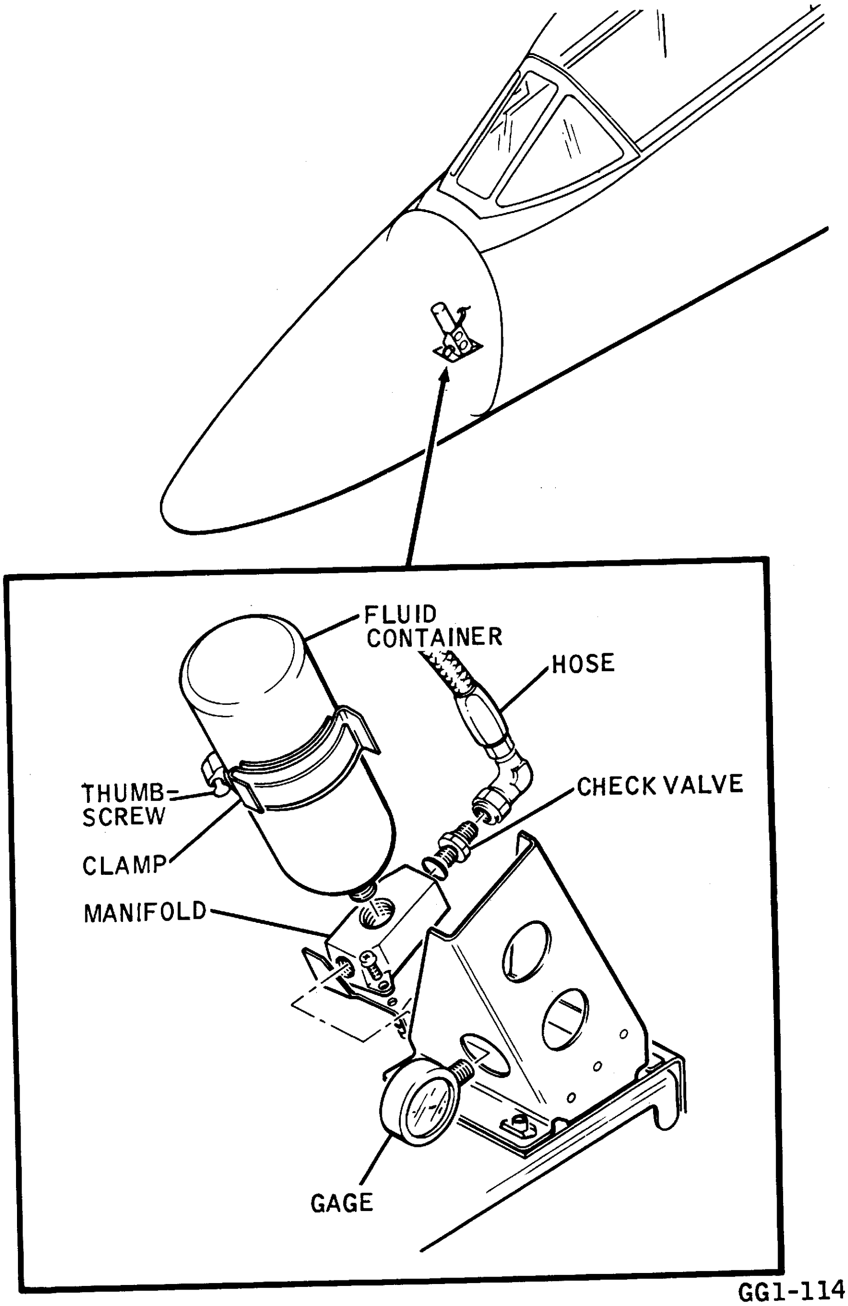


Figure 1-45A. Rain Repellent System Servicing

4. Place new seal (MS28778-8) on full fluid container.

5. Screw container into manifold and secure with lockwire (MS20995N32).

NOTE

Some loss of pressure and fluid will occur during step 5. Remove fluid residue with cloth.

6. Tighten thumbscrew on clamp that holds container in support bracket.

7. Inspect area for cleanliness.

8. Close nose section. Insure that nose section is secure.

Servicing Rain Repellent Fluid Container

Servicing the rain repellent fluid container consists of refilling and recharging the container. Prior to servicing the container, secure a portable manifold assembly identical to the aircraft installation with the exception that the check valve is reversed.

1. Place container on work table with check valve up.

2. Bleed off dry nitrogen by depressing check valve.

3. Cut lockwire and unscrew check valve from neck of container. Empty remaining fluid from container into a measuring bottle.

4. Fill measuring bottle with 425 ± 25 milliliters of rain repellent fluid (MIL-R-81261) and empty fluid into rain repellent container.

NOTE

Until the rain repellent fluid is available through normal supply channels, it is possible to mix locally. The following mixture produces approximately 5 gallons of rain repellent fluid.

10 percent (12.8 fl. oz.) Rain Repellent Fluid Solution 2911L-66	Foster D. Snell So., Chemists and Engineers, New York City, New York 10007
0.5 percent (0.64 fl. oz.) Wetting Agent ARQUAD 2C-75	Armour Industrial Chemicals, Chicago, Illinois 60603
89.5 percent (114.56 fl. oz.) Freon-TF	E. I. Dupont DeNemours and Co., Inc., Wilmington, Delaware 19801

5. Replace check valve and secure to neck of container with lockwire (MS20995N32).

6. Screw container into portable manifold assembly.

7. Attach hose from dry nitrogen supply to container and charge container to 75 to 100 psi.

8. Unscrew container from manifold.

9. Cover container check valve with suitable protective cap to protect against dust and accidental depressurization of container.

NOTE

Until container is used, store in dry storage area with tag that gives servicing information.

LIQUID OXYGEN SYSTEM SERVICING

Servicing of the 10-liter liquid oxygen system (figure 1-46) is accomplished by means of a portable external source. Liquid oxygen from an insulated servicing trailer is transferred under pressure to the aircraft system. Because of the nature of liquid oxygen, no external pressure source is required, as evaporation builds up sufficient pressure within the servicing trailer to complete the operation.

Filling Converter

1. Make certain oxygen switch in cockpit is in OFF position.

2. Open liquid oxygen compartment access door.

3. Remove filler valve cap from filler valve.

4. Purge filler hose on servicing trailer until oxygen flows in steady, uninterrupted stream.

5. Connect filler hose immediately to converter filler valve and commence filling.

NOTE

Any prolonged delay in connecting filler hose may allow liquid oxygen in hose to change to gaseous oxygen. Pressure in servicing trailer should be between 45 to 50 psi.

6. When liquid oxygen flows from overflow vent port in steady stream, close fill drain valve on servicing trailer; disconnect filler hose from filler

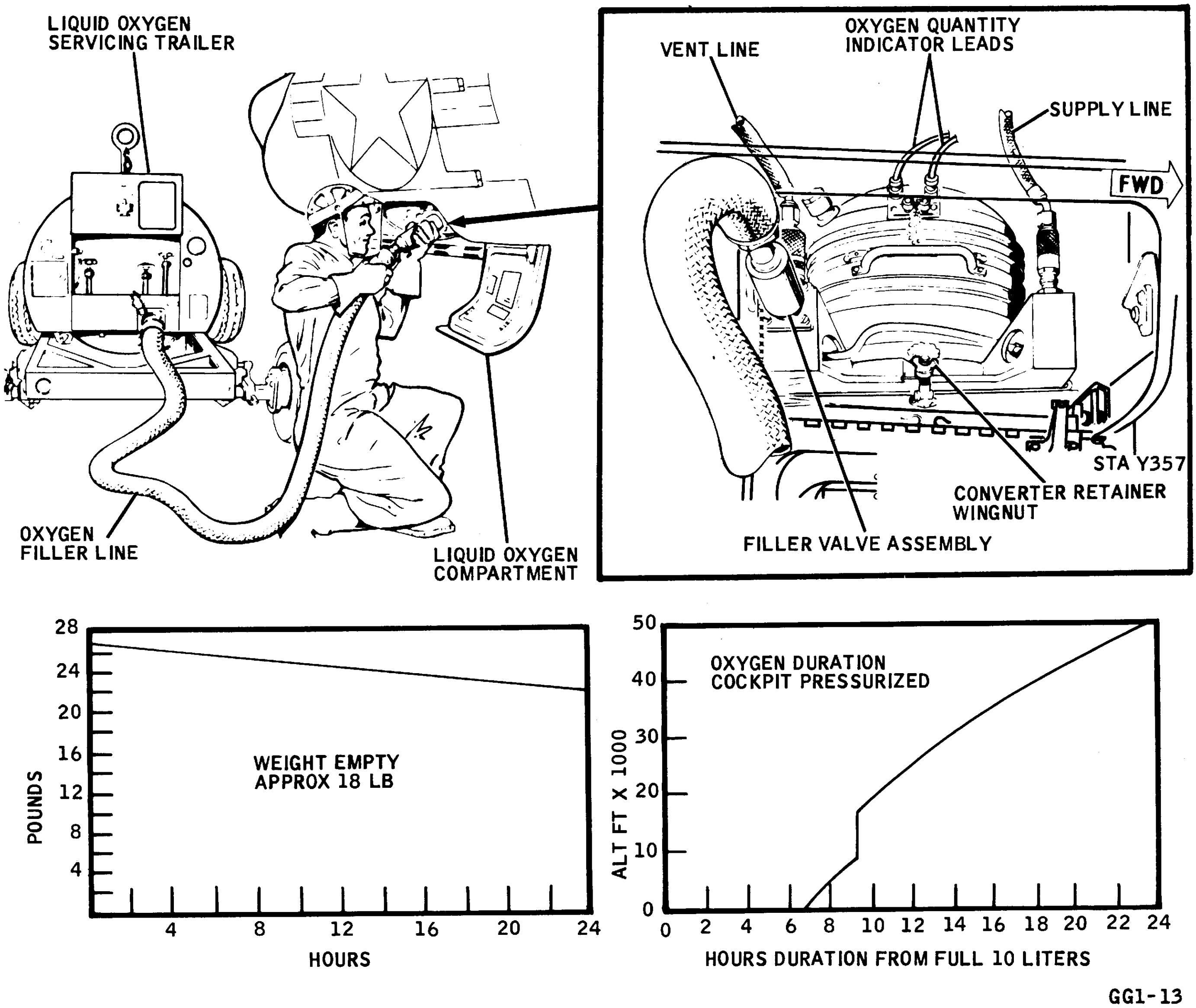


Figure 1-46. Liquid Oxygen System Servicing

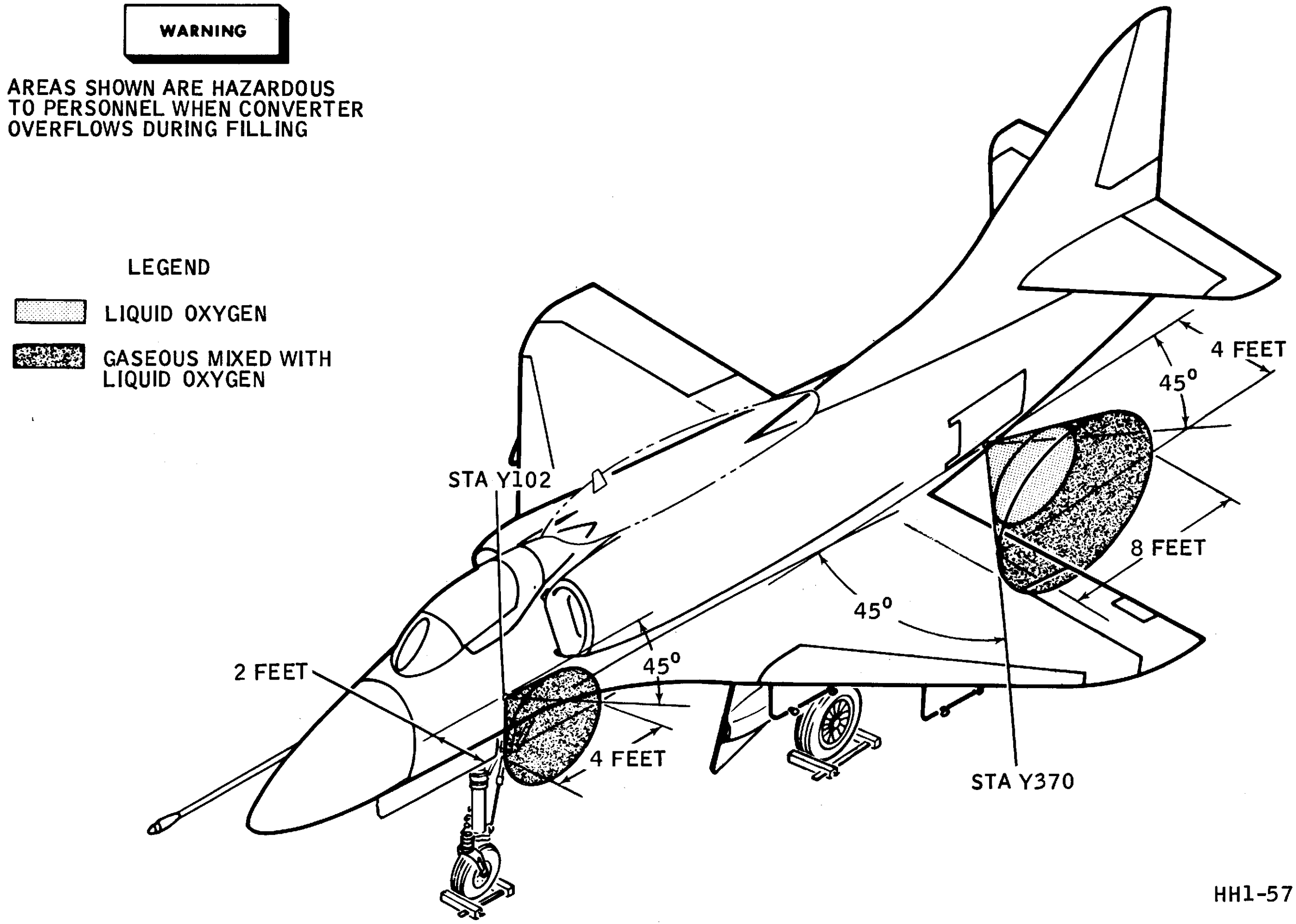


Figure 1-47. Liquid Oxygen Handling Precautions

valve which will automatically return converter to BUILDUP position.

WARNING

Warn all personnel working on aircraft and in area to stay clear of liquid oxygen overflow (figure 1-47.)

NOTE

If the converter filler valve freezes during filling, remove filler hose and install filler valve cap. Recheck filler valve after approximately 10 minutes.

7. Relieve pressure in servicing trailer filler hose by engaging filler nozzle in purging device on trailer.

8. Install dust cap on filler valve.

NOTE

Prior to installing filler valve dust cap, inspect cap closely for evidence of water. If water or moisture is noted, dry thoroughly with compressed air because water in cap may freeze in filler valve.

9. Install dust cap on filler hose nozzle.

10. Secure liquid oxygen compartment door.

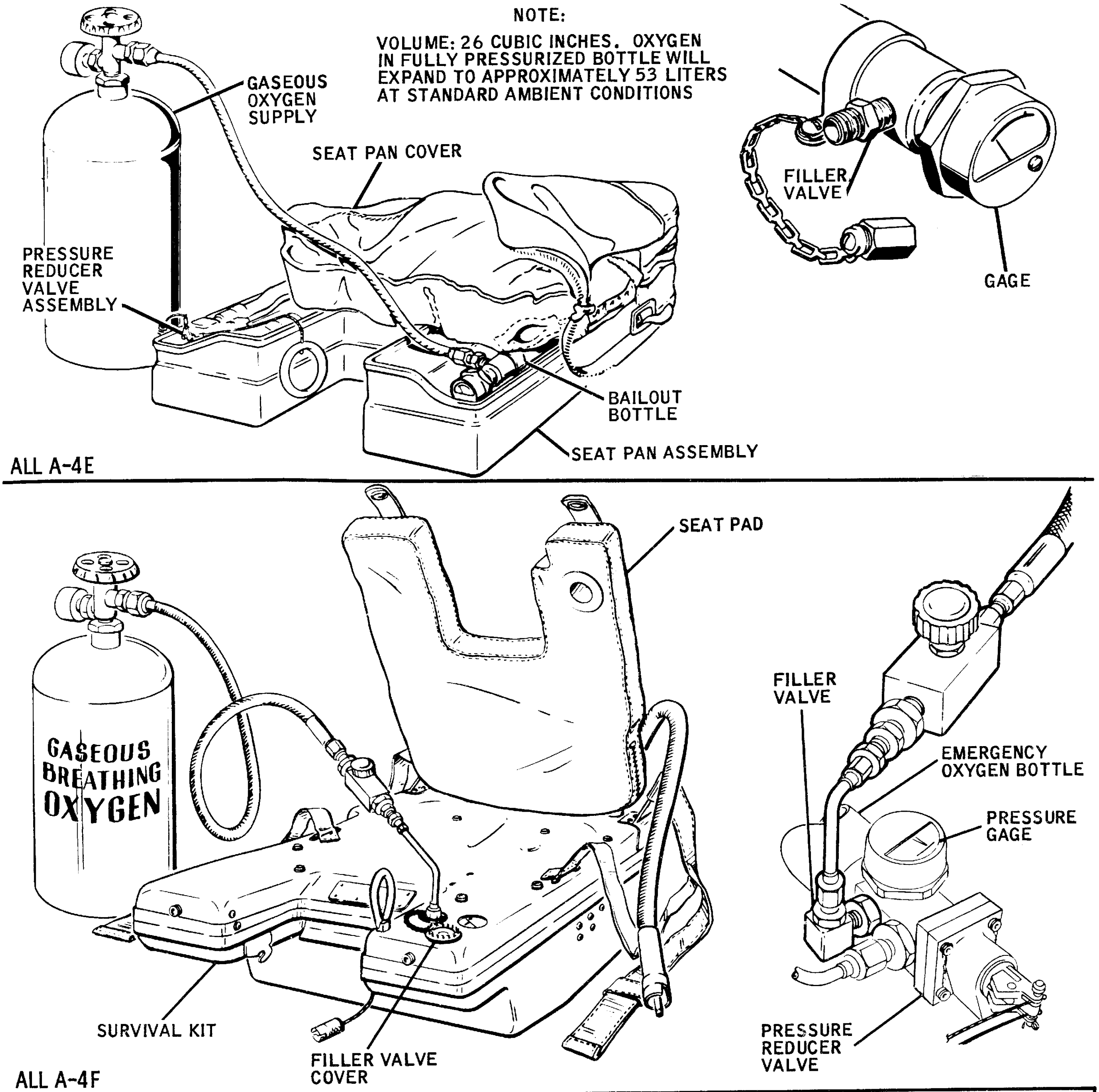
Emergency Oxygen Bottle Servicing

(See figure 1-48.)
Effectivity: All A-4E aircraft

a Remove parachute and seat pan assembly from the aircraft.

b. Place parachute and seat pan assembly on clean work table.

c. Unzip seat pan cover and fold cover back for access to filler valve.



WARNING

MAKE CERTAIN PRESSURE REDUCER VALVE ASSEMBLY AND LOCKWIRE ARE NOT DAMAGED OR BROKEN DURING SERVICING (REFER TO SECTION IV).

EMERGENCY OXYGEN BOTTLE CHARGING PRESSURE (A-4E/F)

AMBIENT AIR TEMPERATURE F°	AMBIENT AIR TEMPERATURE C°	CHARGING PRESSURE (psi)	AMBIENT AIR TEMPERATURE F°	AMBIENT AIR TEMPERATURE C°	CHARGING PRESSURE (psi)
0	-18	1600	70	21	1925
10	-12	1650	80	27	1950
20	-7	1675	90	32	2000
30	-1	1725	100	38	2050
40	5	1775	110	43	2100
50	10	1825	120	49	2150
60	16	1875	130	54	2200

GG1-29

Figure 1-48. Emergency Oxygen Bottle Servicing

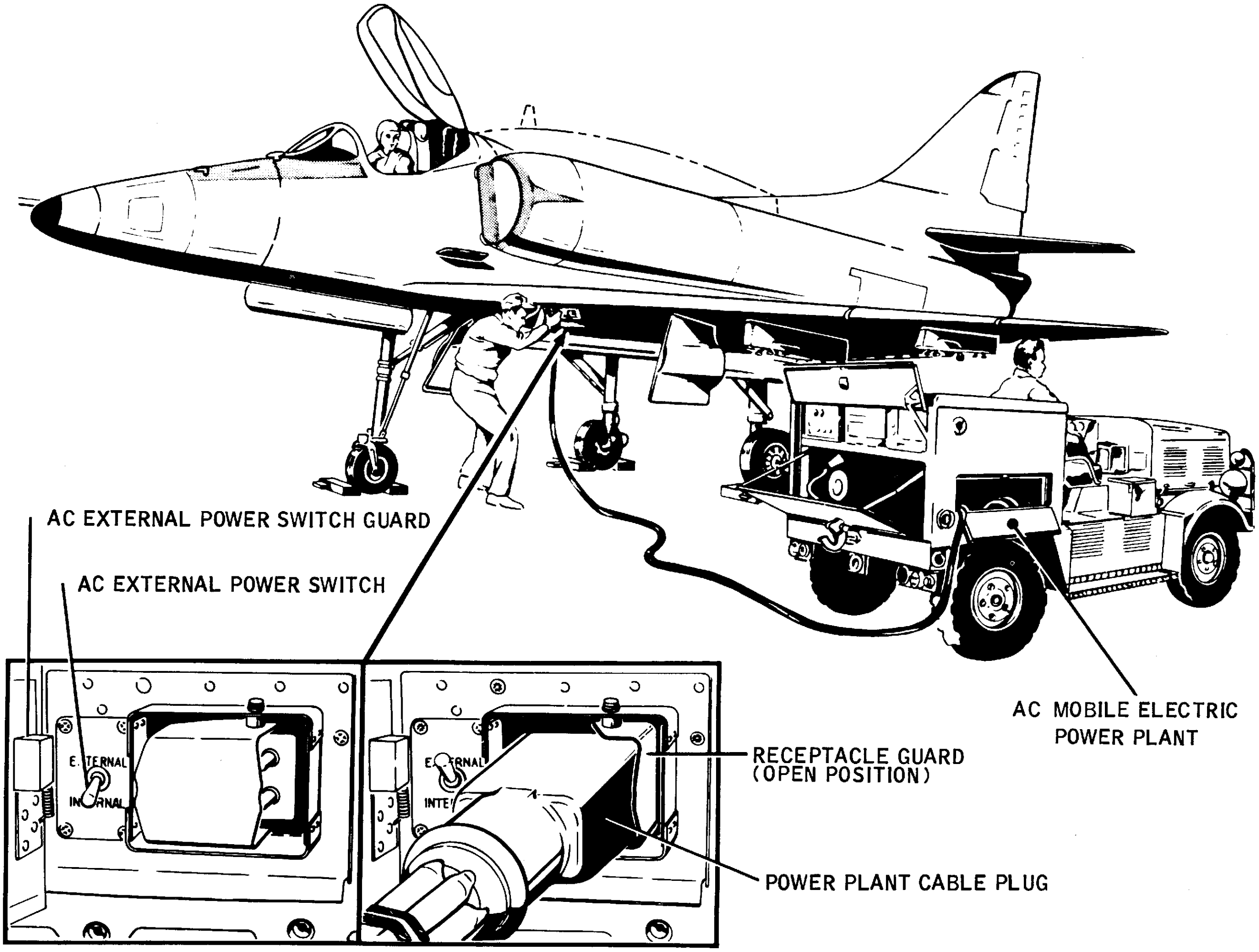


Figure 1-49. External Power Application

HH1-60

d. Connect source of gaseous oxygen and charge bottle to correct pressure compensated for ambient air temperature.

e. Disconnect oxygen supply from filler valve and check valve for leakage.

f. Zip seat pan cover closed.

g. Install parachute and seat pan assembly in ejection seat.

Emergency Oxygen Bottle Servicing

(See figure 1-48.)
Effectivity: All A-4F aircraft

1. Unsnap seat pad at snap fasteners and fold pad back for access to filler valve cover.

2. Pry filler valve access hole cover upward from cutout on left-hand side of survival kit at position adjacent to emergency oxygen bottle pressure gage.

3. Loosen and remove filler cap on filler valve.

4. Connect source of gaseous oxygen (MIL-O-27210) to emergency bottle filler valve. Charge bottle to correct pressure compensated for ambient air temperature.

5. Disconnect oxygen supply from filler valve and check valve for leakage.

6. Install filler cap on filler valve. Press filler valve access hole cover into cutout above filler valve until cover prongs retain cover securely.

7. Fold seat pad forward into place and secure snap fasteners to mating parts on survival kit.

EXTERNAL POWER APPLICATION

Two methods of applying ac external power to the aircraft are available. The primary or standard method uses an ac mobile electric powerplant, NC-5

or equivalent, (figure 1-49). The second method enables a ground crewman to apply ac power, dc power, and starter air through the engine starter access door for pilot-controlled starts, utilizing the aircraft ground start disconnect cable. The second method supplies electrical power only to the start/abort switch and the engine ignition system.

Starting Requirements

A high-pressure air supply to the air turbine starter (installed in the aircraft) and external electrical power is required for starting the A-4.

Suitable Starter Units

Suitable starter units for A-4 aircraft are:

AIR STARTER UNITS (GTC)

USN	USAF
GTC-85	MA-1
MA-1E	MA-1A
* WELLS Air Start System	MA-1TA
	MA-2
MD-3B	MD-1A
	MD-2A

ELECTRICAL POWER UNITS

USN	USAF	RCAF
NC-5	B-10	CAN-C
NC-6	B-10A	
NC-6A	B-10B	
NC-7	MD-3	
NC-8		
NC-10		
NC-12		

COMBINATION ELECTRICAL/AIR STARTER UNITS

USN	USAF
*RCPP/RCPT/NCPP-105	MA-2MP
	MA-3MP
	M32A-60
	*MD-3A

*Set to low pressure ratio.

A source of 115-vac power is required for ignition. Twenty-eight vdc power is required if a cockpit controlled start is desired. Ac power can be provided through the external power receptacle (figure 1-49) or through the aircraft ground start disconnect (figure 1-50). Dc power (for cockpit controlled start) can only be supplied through the aircraft ground start disconnect.

NOTE

If 28-vdc power is not available, a ground start must be accomplished.

FORWARD TOWING PROVISIONS

For forward towing (see figure 1-51), either a standard towbar or an adjustable towbar may be attached to the nosewheel axle. Ensure that main and nose landing gear lockpins are installed before towing aircraft. Standard hand signals shall be utilized to relay instructions to personnel towing aircraft.

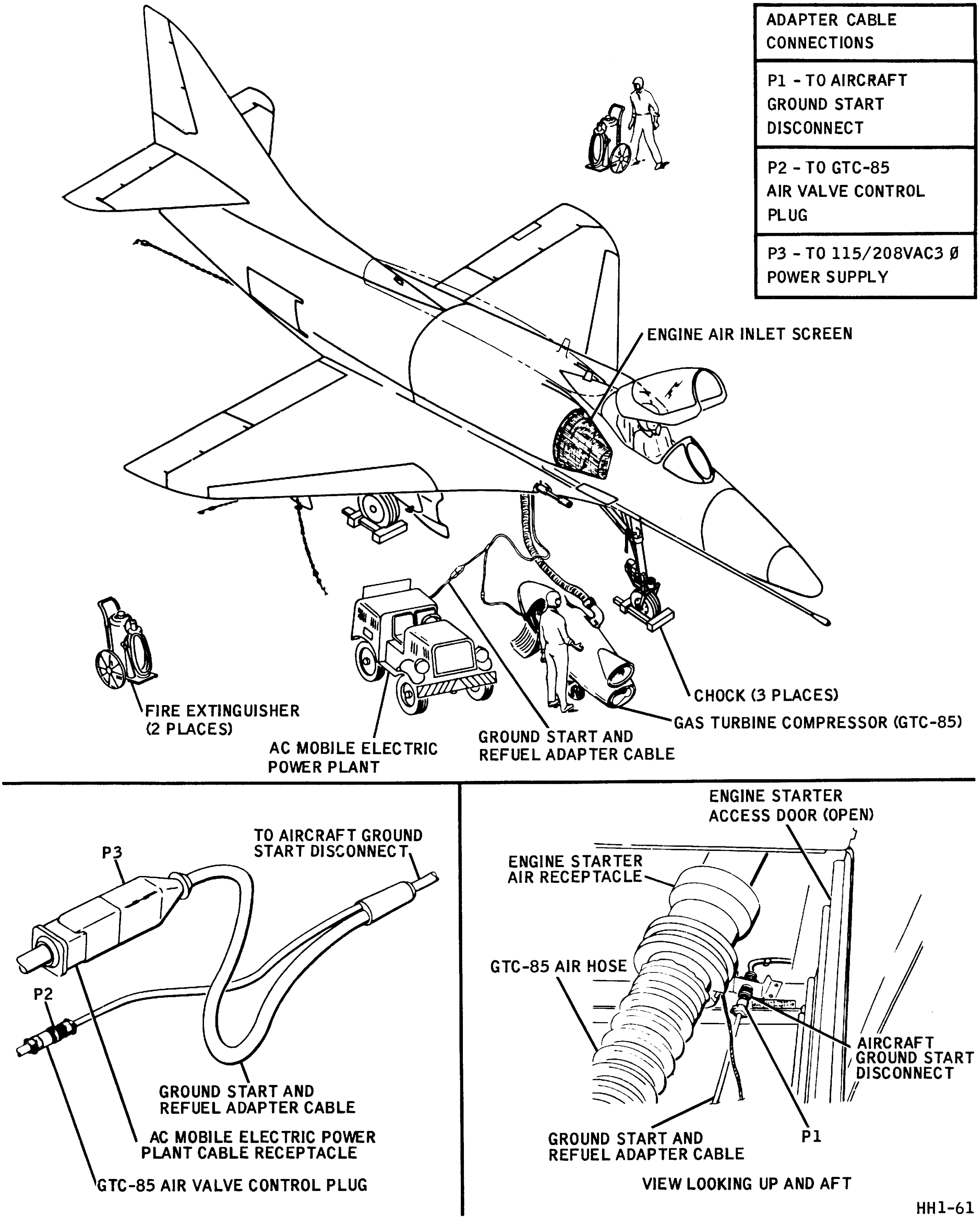
CAUTION

- Towing of aircraft with the engine and tail section removed is not recommended. If the aircraft forward section must be moved, defuel the fuselage fuel cell to improve turning stability, and ensure that enough personnel are available to prevent overturn.
- If the aircraft is to be towed with the canopy open, make certain the canopy internal control handle is in the unlocked position, as bouncing of the canopy, with the control handle locked, can cause fracture of the canopy hinge structure. Do not tow the aircraft without a qualified plane captain in the cockpit.
- Do not exceed a speed of 10 miles per hour while towing along a straight path or 5 miles per hour while turning. Do not make sudden stops.

When high winds prevail, chain tiedown assemblies shall be used to secure aircraft immediately when parked.

Towing Safety Precautions

Towing the aircraft safely requires the undivided attention of all personnel concerned. Ensuing text defines limitations which should not be exceeded and procedures which should be followed for maximum safety.



ADAPTER CABLE CONNECTIONS
P1 - TO AIRCRAFT GROUND START DISCONNECT
P2 - TO GTC-85 AIR VALVE CONTROL PLUG
P3 - TO 115/208VAC3 Ø POWER SUPPLY

Figure 1-50. Engine Ground Starting Preliminary Preparations

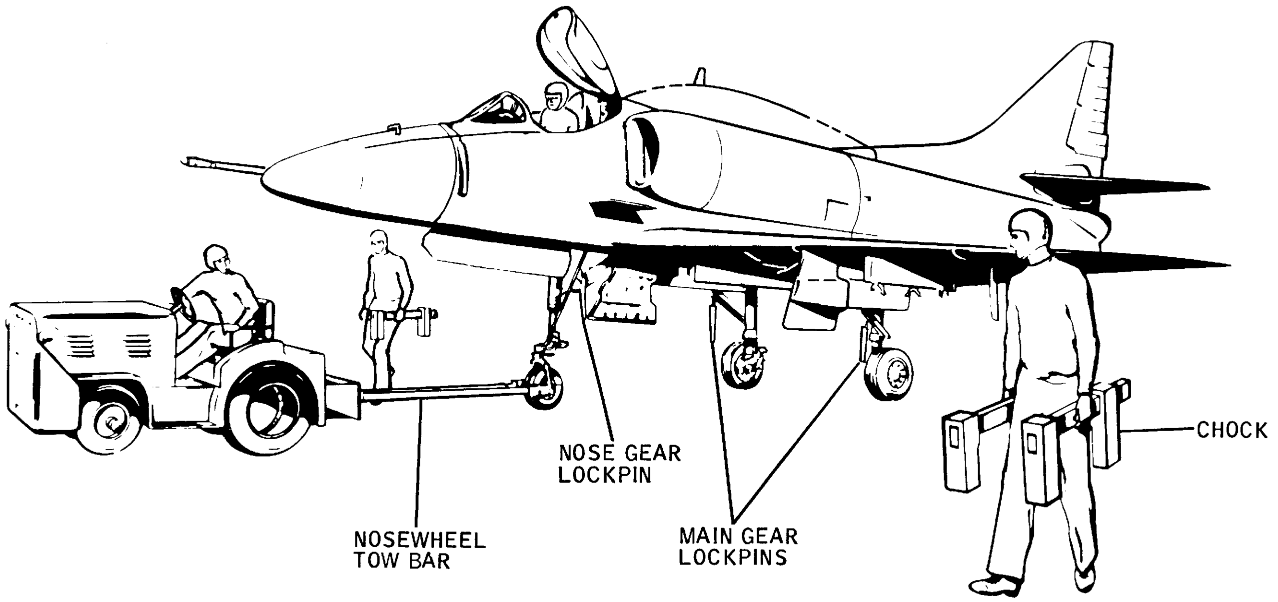


Figure 1-51. Forward Towing

Towing With Asymmetrical Loads

Asymmetrical loading of the aircraft imposes certain limitations on towing. Figure 1-52 shows speeds recommended for towing the aircraft with or without the fuselage aft section attached, and with asymmetrical loads at wing stations X75 and X113.

CAUTION

Turns of less than 10-foot radius shall not be made.

TIEDOWN PROVISIONS

The aircraft can be secured to the ground, flight deck, or hanger deck with chain assemblies attached to tiedown rings on the nose gear, on each main gear, and on each side of the wing lower surface. The nose gear shock strut is provided with two tiedown rings; one on each side. Recommended procedures for normal and heavy weather conditions are contained in subsequent paragraphs.

Ground Tiedown in Normal Weather

(See figure 1-53.)

1. Install landing gear lockpins.

2. Align nosewheel fore and aft, secure nose and main gear wheels fore and aft with chocks, using adjustable chocks if available.

CAUTION

Minimum and maximum angles of tiedown chain in relation to aircraft and ground or deck must be strictly adhered to.

3. Attach chain assemblies to tiedown points indicated for normal weather tiedown and tighten chains.

4. Make certain throttle lever is in OFF position and tighten THROTTLE FRICTION AND LOCK CONTROL.

5. Close canopy.

6. Install cockpit enclosure cover.

7. Install pitot and temperature probe covers.

8. Install manifold exhaust cover.

9. Install aft compartment cooling duct plugs.

10. Install aileron gust lock.

11. Install wing slat locks.

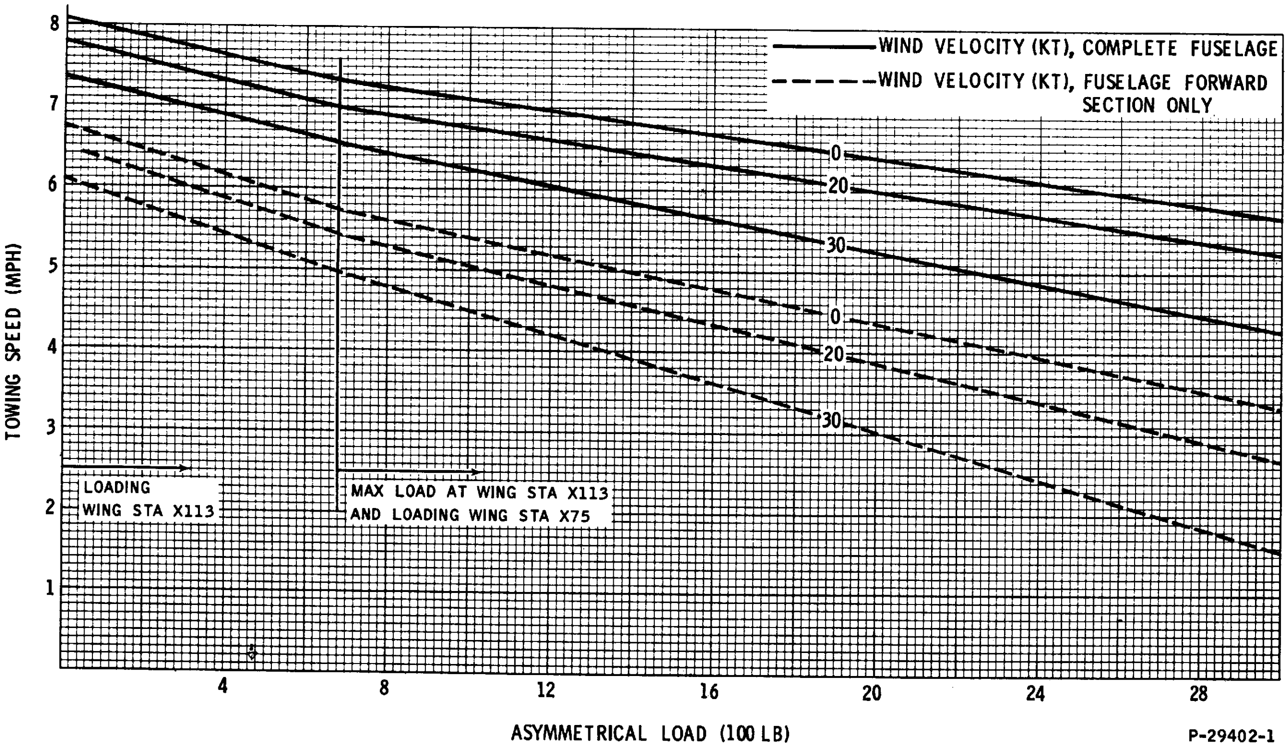


Figure 1-52. Towing Speeds for Asymmetrical Loadings

12. Install engine air inlet covers.

13. Install angle-of-attack vane guard.

14. Install nose compartment cooling duct plugs.

15. Install air conditioning ram air duct plugs.

16. Install engine exhaust cover

17. Remove entrance ladder, if installed.

GROUND TIEDOWN IN HEAVY WEATHER

(See figure 1-53A)

NOTE

The aircraft should be moved into hanger or flown out of storm area if possible.

1. Spot aircraft pointing into direction of maximum expected winds.

2. Remove all armament stores from aircraft.

3. Fuel aircraft to maximum weight.

4. Chock nosewheel and main gear wheels with adjustable chocks.

5. Install tiedown chains as shown in figure 1-53A with aircraft in a maximum gross weight configuration exceeding 15,600 pounds.

6. Ensure throttle is off and tighten friction and lock control.

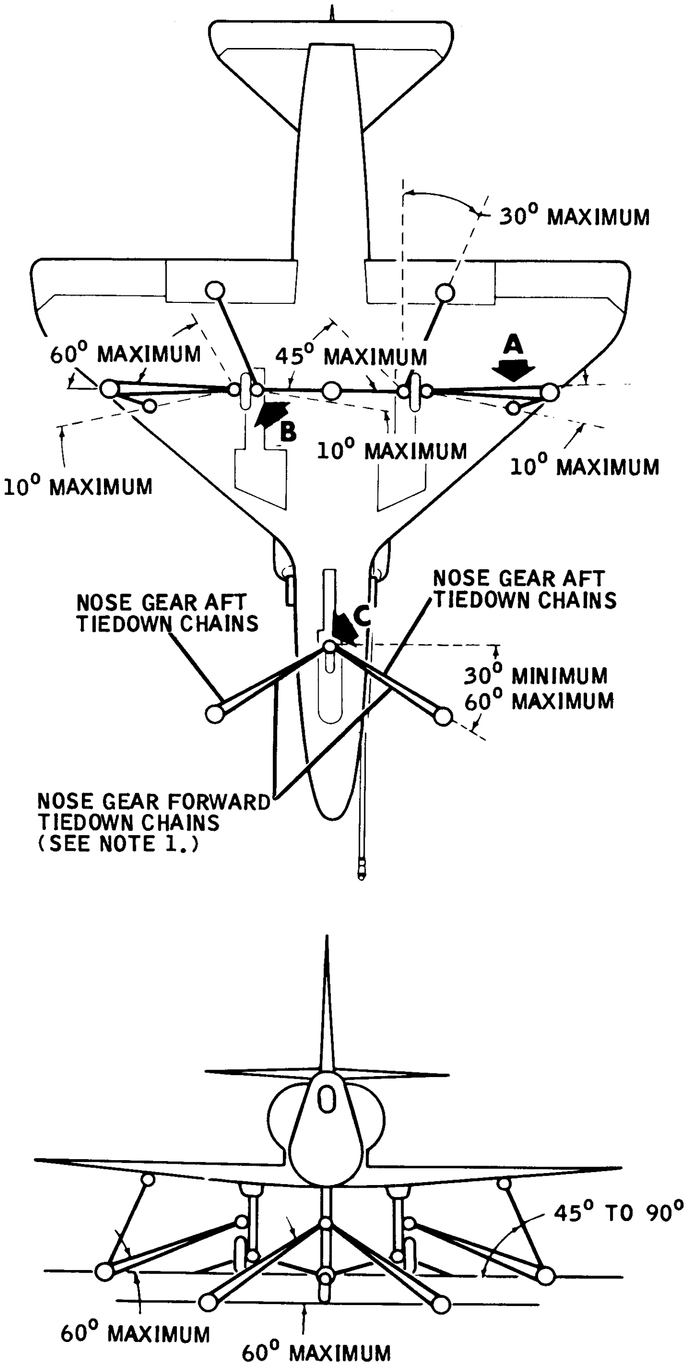
7. Install damage prevention equipment as listed in steps 5 through 17 under procedures for ground tiedown in normal weather.

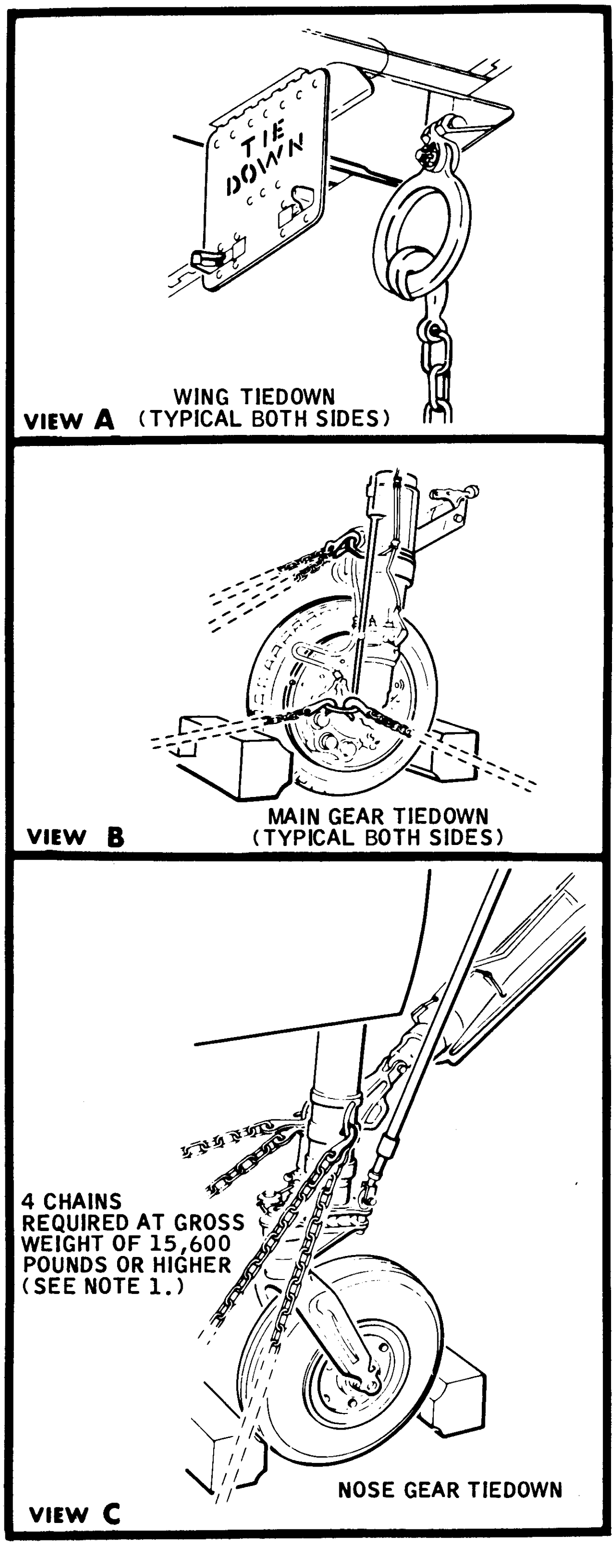
DANGER AREAS

During ground operation certain hazardous areas exist. These areas are depicted in figure 1-54.

TURNING RADII

For turning radii of the A-4E/F aircraft, see figure 1-55.





NOTE

1. NOSE GEAR FORWARD TIEDOWN CHAINS NOT REQUIRED WHEN GROSS WEIGHT IS LESS THAN 15,600 POUNDS AND AIRCRAFT IS SPOTTED IN FORE AND AFT DIRECTION ON CARRIER
2. MAXIMUM CARRIER GROSS WEIGHT 20,200 POUNDS
3. TIEDOWN CHAIN OR EQUIVALENT 10,000-POUND WORKING LOAD
4. - - - REPRESENTS OUTER LIMIT LOCATION OF DECK TIEDOWN FITTINGS

HH1-69

NEW

Figure 1-53A. Heavy Weather Tiedown

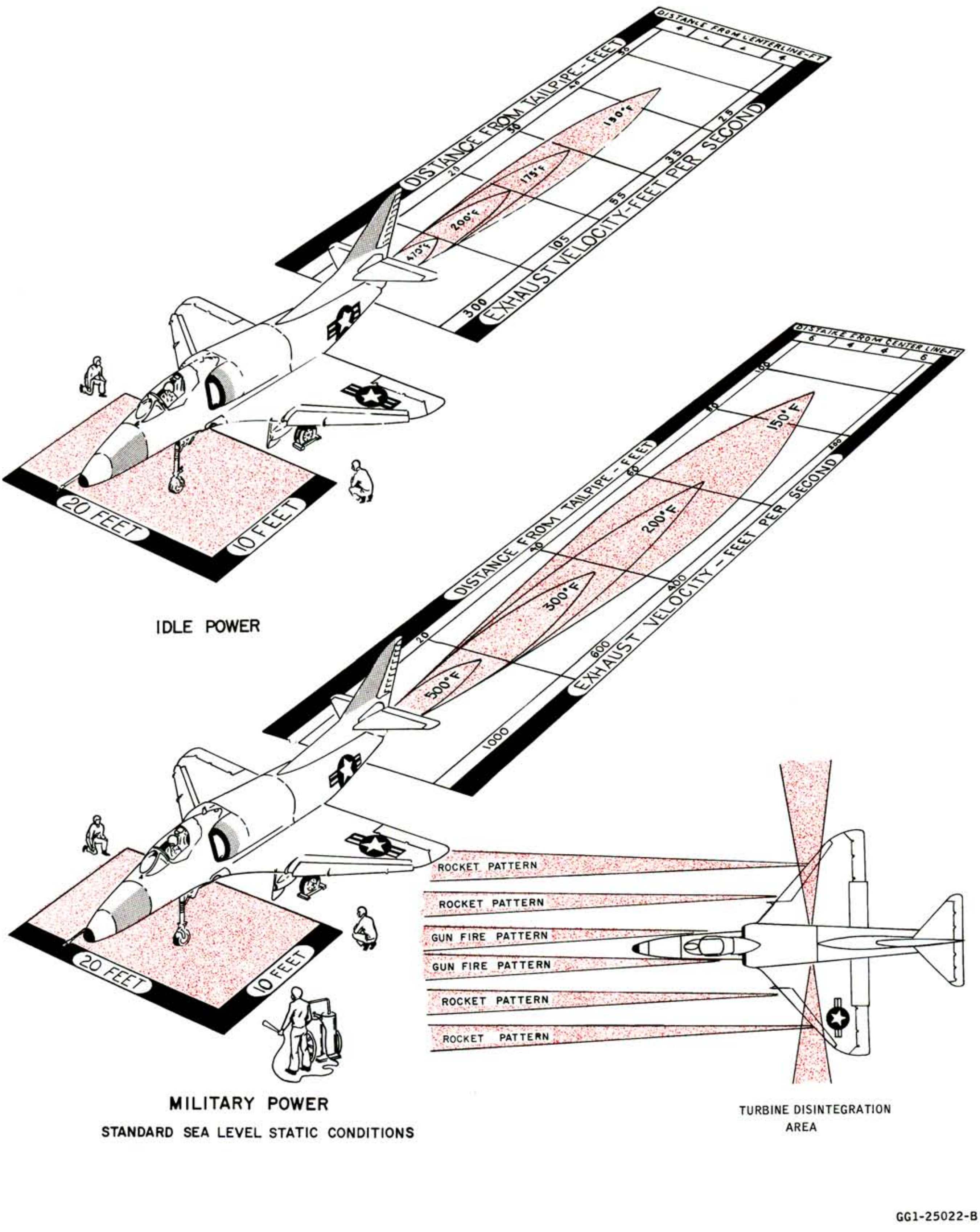


Figure 1-54. Danger Areas (Sheet 1)

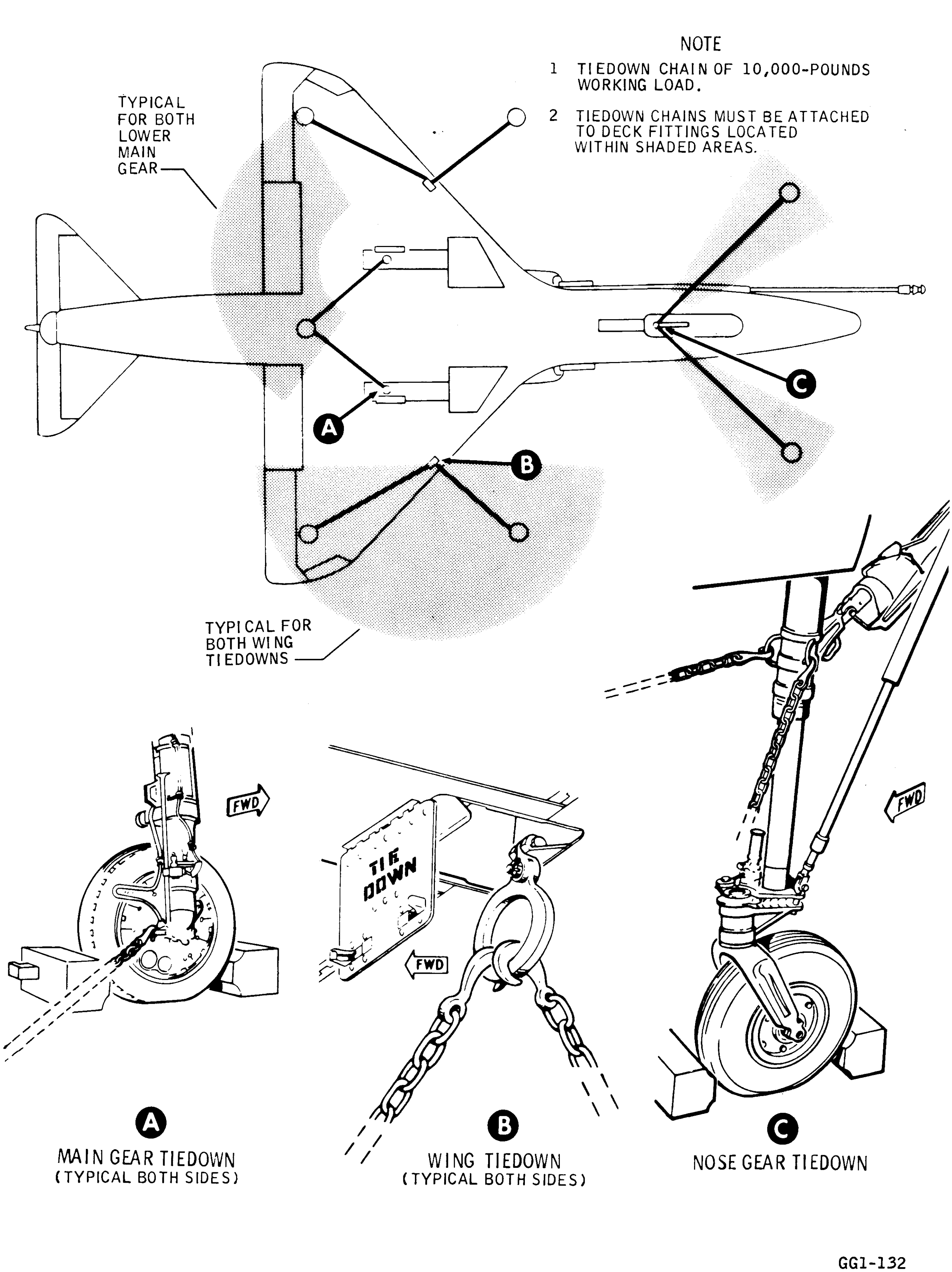


Figure 1-53. Normal Weather Tiedown

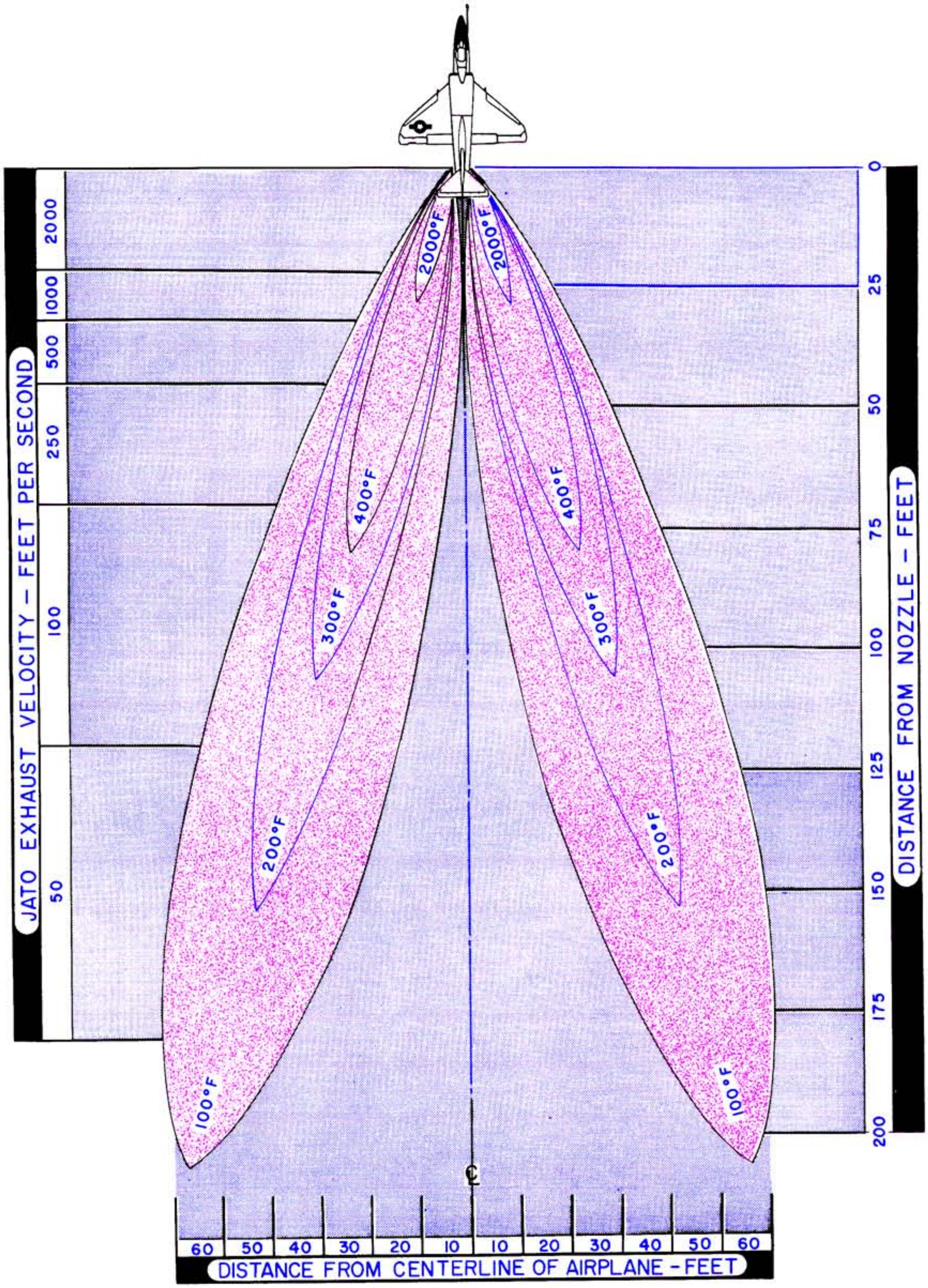


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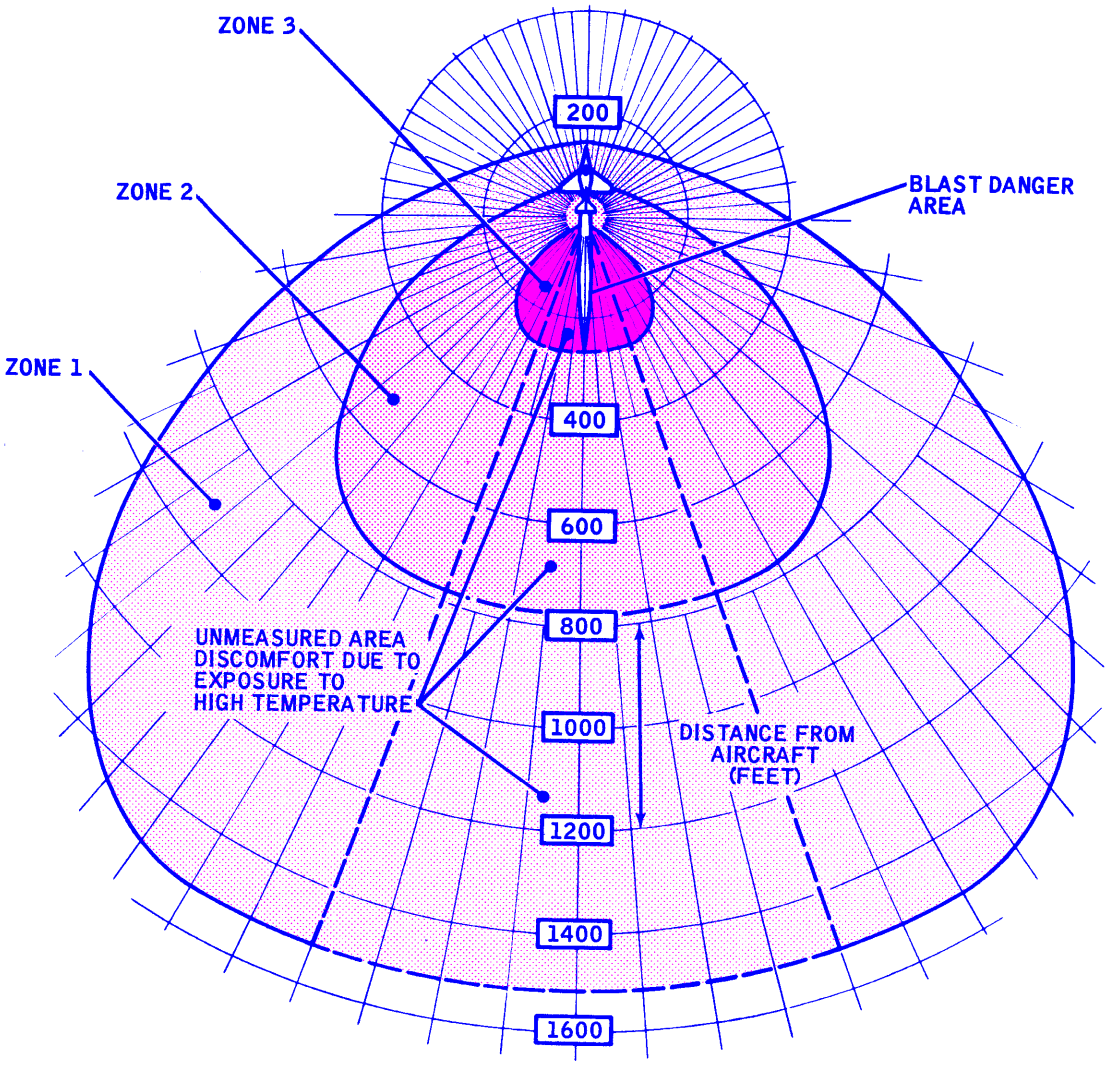
Figure 1-54. Danger Areas (Sheet 2)



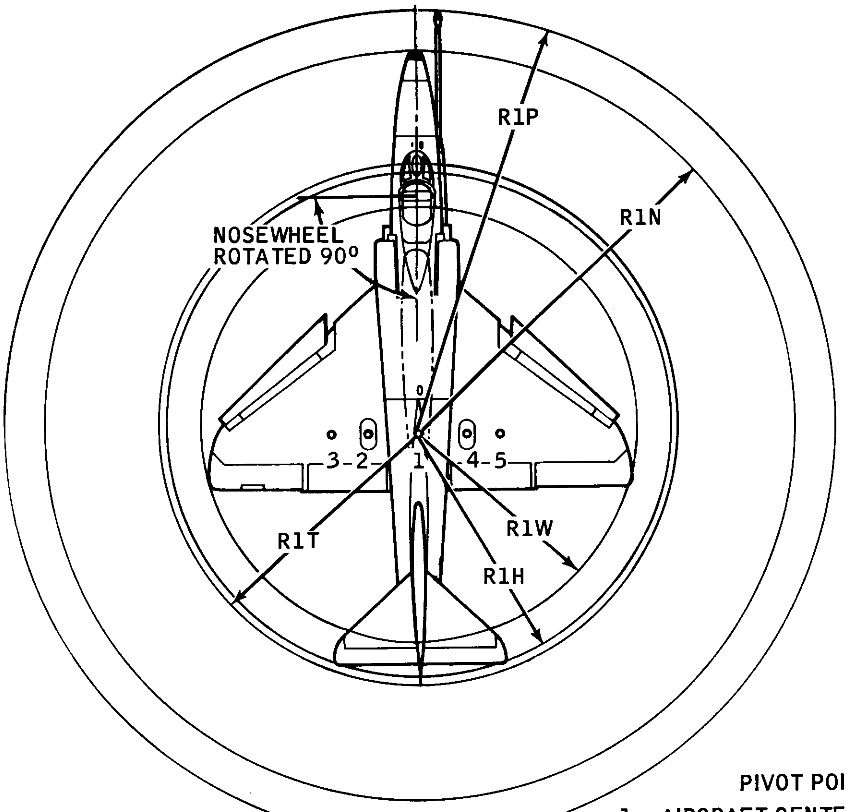
ENGINE TRIM OPERATION 1. ENGINE POWER SETTING AT MILITARY WITH NO SOUND SUPPRESSORS. 2. ZONES ARE BASED ON A FIFTEEN MINUTE EXPOSURE FOR AN EIGHT HOUR PERIOD.	
DANGER AREA	DATA
ZONE 1	EARMUFFS OR EARPLUGS SHALL BE WORN WHEN WORKING WITHIN THIS AREA.
ZONE 2	EARMUFFS AND EARPLUGS SHALL BE WORN WHEN WORKING WITHIN THIS AREA
ZONE 3	CRITERIA FOR FIFTEEN MINUTE EXPOSURE EXCEEDED. PERSONNEL SHALL NOT ENTER EXCEPT FOR VERY SHORT DURATION.

WARNING

1. EAR PROTECTION SHALL BE PROPERLY FITTED TO PERSONNEL.
2. DURING ENGINE OPERATION AT IDLE POWER, EARMUFFS OR EARPLUGS SHALL BE WORN BY PERSONNEL WITHIN 100 FEET OF AIRCRAFT.

GG1-30

Figure 1-54. Danger Areas (Sheet 3)



NOTE

RADII DISTANCES COMPUTED ON 18,554 POUNDS GROSS WEIGHT.

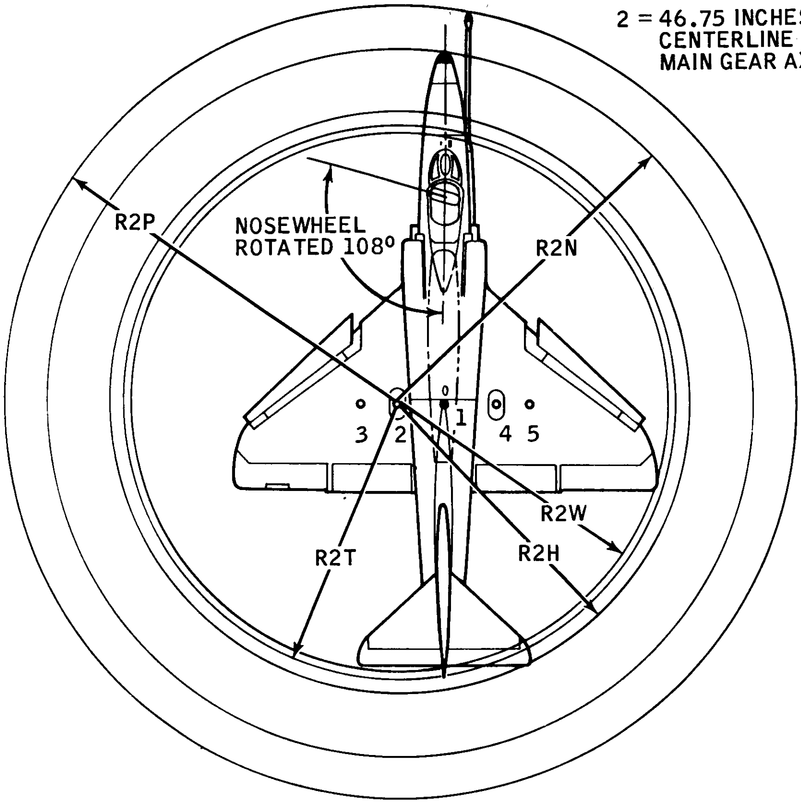
PIVOT POINT 1

R1 TO H	18 FEET 7 INCHES
R1 TO N	22 FEET 2 INCHES
R1 TO P	24 FEET 11 INCHES
R1 TO T	18 FEET 10 INCHES
R1 TO W	15 FEET

CODE

R = RADIUS

PIVOT POINT	TERMINAL POINT
1 = AIRCRAFT CENTERLINE AT INTERSECTION WITH LINE THROUGH MAIN GEAR AXLES	H = HORIZONTAL STABILIZER TIP
2 = 46.75 INCHES LEFT OF CENTERLINE IN LINE WITH MAIN GEAR AXLE	N = NOSE (RADOME) TIP
	P = AIR REFUELING PROBE TIP
	T = RUDDER TRAILING EDGE
	W = WING TIP

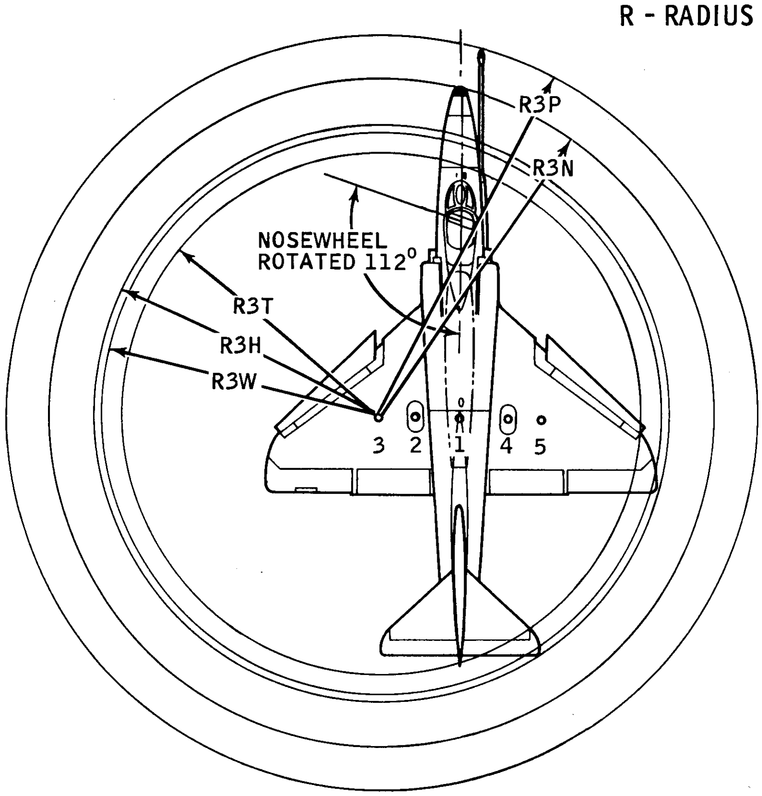


PIVOT POINT 2

R2 TO H	20 FEET 2 INCHES
R2 TO N	22 FEET 6 INCHES
R2 TO P	25 FEET 5 INCHES
R2 TO T	19 FEET 2 INCHES
R2 TO W	18 FEET 7 INCHES

HH1-65

Figure 1-55. Minimum Turning Radius (Sheet 1)



CODE
R - RADIUS

PIVOT POINT

3 = 58.75 INCHES LEFT OF CENTERLINE IN LINE WITH MAIN GEAR AXLE

4 = 46.75 INCHES RIGHT OF CENTERLINE IN LINE WITH MAIN GEAR AXLE

5 = 58.75 INCHES RIGHT OF CENTERLINE IN LINE WITH MAIN GEAR AXLE

TERMINAL POINT

H = HORIZONTAL STABILIZER TIP

N = NOSE (RADOME) TIP

P = AIR REFUELING PROBE TIP

T = RUDDER TRAILING EDGE

W = WING TIP

PIVOT POINT 3

R3 TO H	20 FEET 8 INCHES
R3 TO N	22 FEET 8 INCHES
R3 TO P	25 FEET 8 INCHES
R3 TO T	19 FEET 5 INCHES
R3 TO W	19 FEET 7 INCHES

PIVOT POINTS 4 AND 5

R4P = 24 FEET 9 INCHES R5P = 24 FEET 11 INCHES

HHI-66

Figure 1-55. Minimum Turning Radius (Sheet 2)

PART 4
OPERATING LIMITATIONS

INTRODUCTION

This section contains important operating limitations that shall be observed during normal operating of the aircraft. Refer to NAVAIR 01-40AV-1T for additional limitations.

ENGINE LIMITATIONS

Restrictions to be observed in the operation of the engines are based upon the use of fuel as follows:

	Approved Fuel	
	Ashore	Afloat
Recommended	JP-5	JP-5
Alternate	JP-4	

ENGINE OPERATING LIMITS

Exhaust Gas Temperature and Engine Speed

Engine limitations are based on combinations of engine speeds and exhaust gas temperatures, with a maximum allowable engine speed under any condition of 102.6 percent (11,900 rpm) for J52-P-6A/B engines, or 102.9 percent (12,400 rpm) for J52-P-8A/B engines. Mechanical speed limits of 102.6 percent (P-6A/B) and 102.9 percent (P-8A/B) are overspeed limits and are not to be exceeded. Rpm in excess of 101 percent indicates a probable fuel control malfunction and/or trim error.

STARTING TEMPERATURES

If engine exhaust gas temperature (EGT) exceeds 455°C five times, or reaches 531°C for one period of 5 seconds or more, engine must be subjected to an overtemperature inspection. Any EGT exceeding 565°C for any period of time will require a teardown inspection of all hot section parts. Refer to Service Instructions J52-P-6A/P-8A Engine, NAVAIR 02B-10DAA-2 for overtemperature inspection procedures.

Operating Condition	Max EGT °C	Max % RPM	Time Limit
Starting limits	455	(Start to idle)	2 minutes
Idle	340	50 to 60	. . . .
Acceleration			
J52-P-6A	650	Military	8 minutes
J52-P-6B	660	Military	8 minutes
J52-P-8A/B	680	Military	8 minutes
Normal			
J52-P6A/B	590	Military	. . . .
J52-P-8A/B	595	Military-3%	
Military			
J52-P-6A	610	Military	30 minutes
J52-P-6B	621	Military	30 minutes
J52-P-8A/B	650	Military	30 minutes

The IDLE temperature of 340°C is not a limit but is given as a guide to indicate the temperatures which, if exceeded, may signify an engine malfunction. Following acceleration. EGT may overshoot the stabilized value for a given throttle setting, and require some time to decrease to that value. After "peaking" EGT will decrease quite rapidly at first; then decrease progressively more slowly as it approaches the stabilized value. EGT should not stabilize at any point above the maximum steady-state value. The above limits for acceleration and temperatures should be interpreted to mean that the EGT for J52-P-6A engines may go to 650°C during acceleration but must decrease to 610°C or less within 8 minutes after acceleration; EGT for J52-P-6B engines may go to 660°C during acceleration but must decrease to 621°C or less within 8 minutes after acceleration; EGT for J52-P-8A/B engines may go to 680°C during acceleration but must decrease to 650°C or less within 8 minutes after acceleration. In normal operation EGT overshoot rarely occurs.

ENGINE SPEED

Rpm varies between engines at MILITARY thrust. For each engine, the specific rpm required to produce MILITARY thrust under standard day conditions is placarded on the engine data plate. Most engines will fall in the range of 97 to 100 percent. The pilot should therefore expect to see tachometer rpm indicate in this range at full throttle. The rpm at MILITARY thrust also varies noticeably with changes in inlet temperature. The amount of variation from data plate rpm depends on the type fuel control installed but is approximately +1 to -2 percent for extreme conditions of hot and cold respectively. (See figure 1-56.) The 30-minute time limit at MILITARY thrust is a power level limit rather than a temperature limit; that is a particular engine which develops MILITARY thrust at an exhaust gas temperature of 540°C is still limited to 30 minutes at this power even though it is below the MILITARY operating temperature limit.

NOTE

Engine compressor stalls may be induced above 30,000 feet in heavy airframe buffet at high angles-of-attack.

CAUTION

For aircraft with reduced smoke engines installed (J52-P-8B engines or J52-P-8A engines with PPC 185 incorporated), a minimum inflight engine rpm of 70 percent should be maintained except during landing.

OIL PRESSURE VARIATION

The oil pressure indication at IDLE RPM should be normal (40 to 50 psi); however, a minimum of 35 psi for ground operation is acceptable. If the indication is less than 35 psi at 60 percent rpm, shut down the engine to determine the reason for the lack of, or low, oil pressure.

CAUTION

- Even though certain maneuvers normally cause a momentary loss of oil pressure, maximum operating time with an oil pressure indicating less than 40 psi in flight is 1 minute. If oil pressure is not recovered in 1 minute, the flight should be terminated as soon as practicable.
- Maneuvers producing acceleration near zero g may cause complete loss of oil pressure temporarily. Absence of oil pressure for a maximum of 10 seconds is permissible.
- If the oil pressure indicator reads high (over 50 psi), the throttle setting should be made as soon as possible, and the cause investigated.

NOTE

During starting and initial runup, the maximum allowable oil pressure is 50 psi.

MANEUVERS

NOTE

Intentional spins are prohibited.

The following maneuvers are permitted:

1. Inverted flight (not to exceed 30 seconds)
2. Loop
3. Aileron roll
   a. Not to exceed 360 degrees
   b. Not to exceed one-half stick deflection with fuel in the 300-gallon drop tanks, except that above 20,000 feet full stick deflection may be used for rolls up to 180 degrees.
4. Wingover
5. Immelmann
6. Chandelle
7. Barrel roll

ROYAL AUSTRALIAN NAVY

SUPPLEMENT No 3

to

AP(RAN) NA01-40AVC-1 Section 1 Part 4 Page 1-131
15 Nov 68 Changed 1 March 1969

INTRODUCTION

1. This supplement provides information on the maximum permissable centre of gravity range for the clean aircraft.

REQUIREMENTS

2. Under the heading of "Centre of Gravity Limitations", page 1-131 include the following requirements:

The maximum permissable centre of gravity range for the clean aircraft are:

Gear Down	15.8 to 29.5% of MAC
Gear Up	14.5 to 28.5% of MAC

Refer to the Handbook of Weight and Balance Data AN01-1B-40 for C of G limits as affected by external store loadings.

SAMR
SYDNEY
NOVEMBER 1969

Royal Australiaan Navy

Supplement 2

to

AP(RAN)NAO1-40AVC-1 Sec 1, Pt 4, Page 1-133, Fig 1-57

INSTRUMENT MARKINGS

INTRODUCTION

1. This supplement specifies the revised limit markings for the Oil Pressure Guage.

REQUIREMENT

2. Delete reference to the Oil Pressure Indicator Markings shown in Fig. 1-59 and refer to the new limit markings in Fig. 1 below.

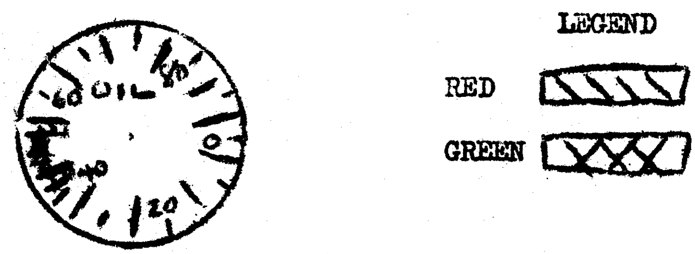


FIG 1 OIL PRESSURE GUAGE LIMIT MARKINGS

S.A.M.R.
SYDNEY
NOVEMBER 69

The maximum permissible change in angle of bank during rolling pullouts or rolling pushovers is 180 degrees.

AIRSPEED LIMITATIONS

The maximum permissible indicated airspeeds in smooth or moderately turbulent air are:

1. With no external stores and with landing gear, flaps, and hook retracted . . . . AS SHOWN IN FIGURE 1-59

2. With 300-gallon drop tanks and with landing gear, flaps, and hook retracted. . . . 575 KIAS OR MACH 0.90, WHICHEVER IS LOWER

NOTE

For other external stores limitations/loadings, refer to NAVAIR 01-40AV-1T.

3. With landing gear and/or flaps extended (except in emergency to lock gear down) . . . . 225 KIAS (WITH ZERO YAW) 170 KIAS (WITH UNRESTRICTED YAW)

CAUTION

With flaps extended, 240 KIAS should not be exceeded without an indication of flap blowback, to prevent structural damage if the blowback relief valve does not operate properly.

4. For air refueling from A-4 tanker, and for buddy store hose extensions . . . . . . 300 KIAS OR MACH 0.80, WHICHEVER IS LOWER

   a. For buddy store hose retraction . . . . 250 KIAS

   b. Carriage . . . . 500 KIAS OR MACH 0.80, WHICHEVER IS LOWER

5. With flight controls disconnected:

   a. With asymmetrical loading . . . . 200 KIAS

   b. With symmetrical loading . . . . 300 KIAS OR MACH 0.80, WHICHEVER IS LOWER

6. With emergency generator extended . . . . 500 KIAS OR MACH 0.91, WHICHEVER IS LOWER

7. Insofar as practicable, utilize strafing speeds of . . . . 350 to 450 KIAS

CENTER-OF-GRAVITY LIMITATIONS

Refer to Chart E of Weight and Balance Handbook, NAVAIR 01-1B-40, for gross weight operating limitations:

GROSS WEIGHT LIMITATIONS

The maximum recommended gross weights are:

1. Field takeoff . . . . 24,500 POUNDS

2. Field landing (minimum rate of descent) . . . . 16,000 POUNDS

3. Field landing (other than minimum rate of descent, FCLP, and field arrestments . . . . 14,500 POUNDS

4. Catapulting . . . . 24,500 POUNDS

NOTE

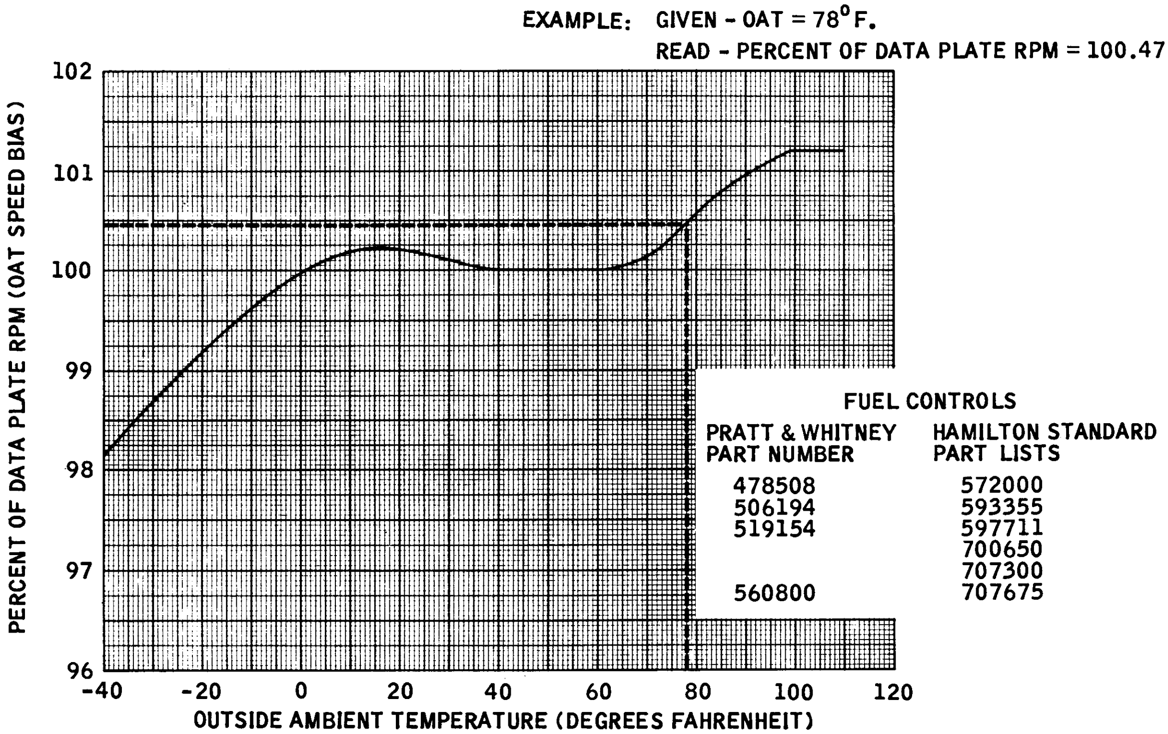
When using C-11/C-11-1 catapult, maximum takeoff weight is 22,800 pounds.

5. Carrier landing, and carrier arrestment. . . . . 14,500 POUNDS

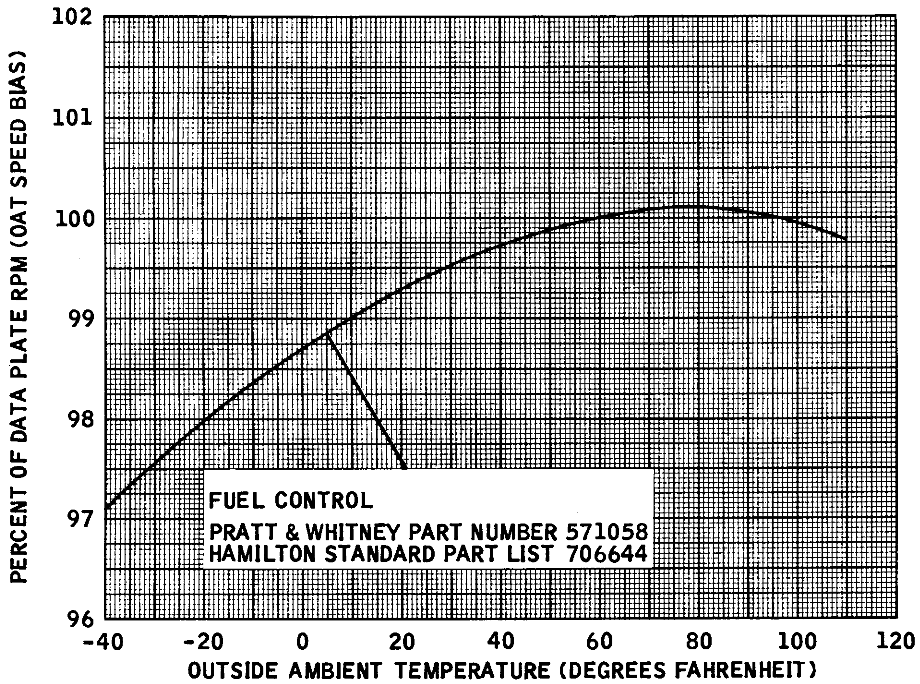
6. Barricade engagement . . . . 14,500 POUNDS

At gross weights in excess of 14,500 pounds, only minimum rate of descent field landings are recommended. Field landings at gross weights in excess of 16,000 pounds should be attempted only in an emergency; refer to section V, Landing at High Gross Weights.

J52-P-6A ENGINE

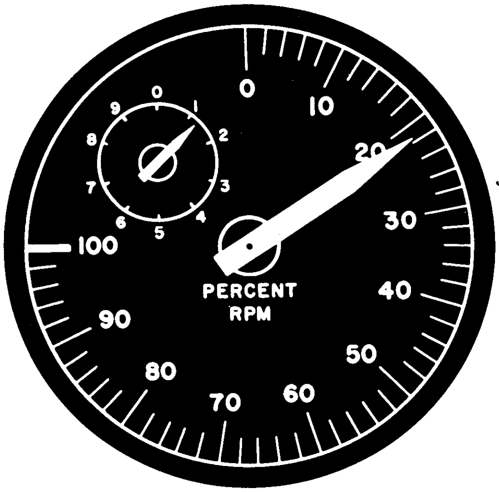


J52-P-8A ENGINE

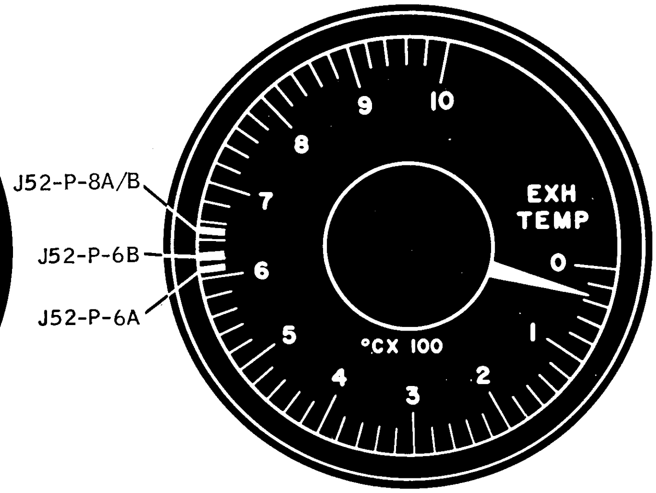


GG1-110

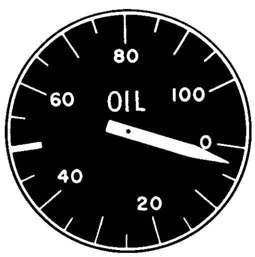
Figure 1-56. Military RPM Curve for Sea Level Static Condition



TACHOMETER



EXHAUST GAS TEMPERATURE



OIL PRESSURE

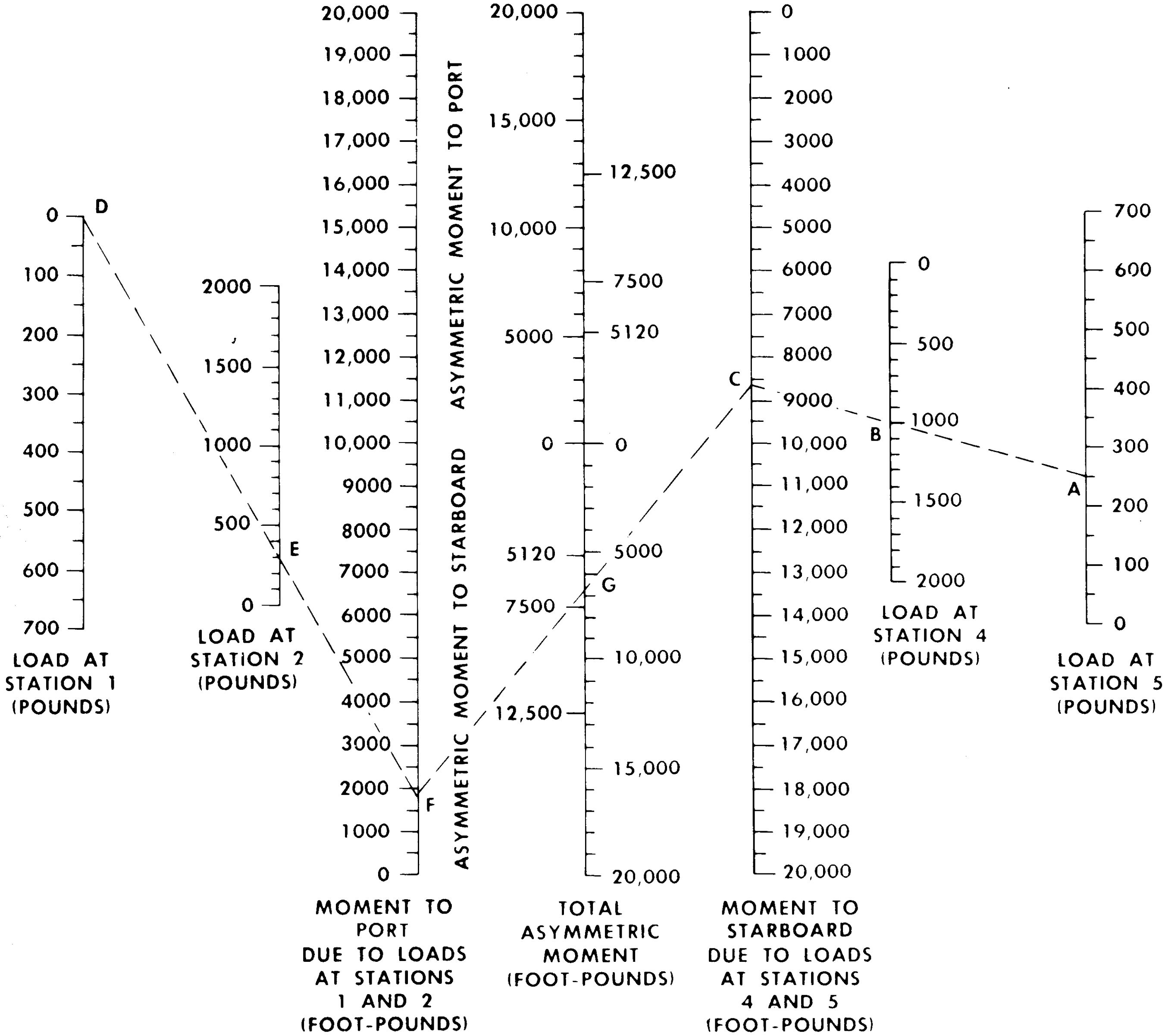
OIL QUANTITY
INDICATOR/SWITCH

ENGINE PERFORMANCE			
	ENGINE		
	J52-P-6A	J52-P-6B	J52-P-8A/B
MAXIMUM STABILIZED RPM (30 MINUTES)	MILITARY	MILITARY	MILITARY
MAXIMUM STABILIZED TEMPERATURE (30 MINUTES)	610° C	621° C	650°C
MAXIMUM ALLOWABLE OIL PRESSURE	50 PSI	50 PSI	50 PSI
MINIMUM ALLOWABLE OIL PRESSURE- INFLIGHT GROUND - IDLE	 40 PSI 35 PSI	 40 PSI 35 PSI	 40 PSI 35 PSI

GG1-31-A

Figure 1-57. Engine Instruments

ASYMMETRIC WING STATION LOAD LIMITATION NOMOGRAM



TO USE THE NOMOGRAM CONNECT THE KNOWN LOADS ON STATIONS 1 AND 2 (FOR MODELS A-4 B/C STATION 5 AND 1 LOADS ARE ZERO) WITH AN EXTENDED STRAIGHT LINE. READ THE MOMENT TO PORT DUE TO LOADS AT STATIONS 1 AND 2. REPEAT THIS PROCEDURE FOR STATIONS 4 AND 5 TO FIND STARBOARD MOMENT. CONNECT THE STARBOARD MOMENT AND PORT MOMENT WITH A STRAIGHT LINE. READ TOTAL ASYMMETRIC MOMENT AT THE INTERSECTION OF THE CONNECTING LINE AND THE TOTAL ASYMMETRIC MOMENT SCALE. IF THE TOTAL ASYMMETRIC MOMENT IS LESS THAN THAT ALLOWED FOR A GIVEN OPERATION THE LOADING IS SATISFACTORY.

LIMITATIONS:

FIELD LANDINGS . . . . 12,500 FT-LB

FIELD TAKEOFFS
OR CARRIER LANDINGS . . . . . . 7500 FT-LB

CARRIER CATAPULT . . . . 5120 FT-LB

EXAMPLE:

A LOAD AT STATION 5 . . . . 250 LB
B LOAD AT STATION 4 . . . . 1000 LB
C MOMENT TO STARBOARD . . . 8620 FT-LB
D LOAD AT STATION 1 . . . . 0 LB
E LOAD AT STATION 2 . . . . 300 LB
F MOMENT TO PORT . . . . 1875 FT-LB
G TOTAL ASYMMETRICAL
MOMENT . . . . 6745 FT-LB

GG1-32-B

Figure 1-58. Asymmetric Wing Station Load Limitation Nomogram

CAUTION

- Barricade engagements may be made with stores such as empty tanks, empty rocket packs, or other lightweight inert stores, but, if torn loose, these stores may present a hazard to flight deck personnel. Barricade engagements are not permitted with stores other than mentioned above. It is recommended that internal wing fuel be burned prior to engagement. Refer to the appropriate recovery bulletin for permissible arresting gear engaging speeds.
- Barrier engagements are not permitted.
- At high gross weights engaging speeds should be held to a minimum to prevent structural damage to the aircraft.
- Additional catapulting gross weight limitations as imposed by increasing ambient temperatures and resultant reduction in engine thrust are extremely critical when operating with stores on the multiple bomb racks in a FULL FLAP or HALF FLAP configuration. Refer to applicable Aircraft Launching Bulletin for more detailed information.
- All drop tanks must be empty prior to an arrested landing.

ASYMMETRIC LOAD LIMITATIONS

1. Store loading giving up 7500 foot-pounds of asymmetric moment are permitted for field takeoffs and carrier landings. The asymmetric load at the outboard rack times 9.48 plus the asymmetric load at the inboard rack times 6.25 must not exceed 7500 foot-pounds. For rapid computation of the allowable asymmetric load (less than 7500 foot-pounds) refer to figure 1-58.

2. Catapult launch with an asymmetrical external stores loading in excessof 5120 foot-pounds is not permitted. The maximum allowable crosswind for asymmetrical loading is 15 knots. Launches with 15 knots crosswind require at least 10 knots above minimum endspeed. For less than the maximum crosswinds, interpolation is permitted to determine required excess endspeed (figure 1-62). A lateral control input will be required to maintain the wings level as the aircraft leaves the bow. Directional trim (away from the more heavily loaded wing) requirements are as follows:

   0 to 10 knots crosswind - 2 units

   11 to 15 knots crosswind - 3 units

3. Landing with a crosswind component under the unloaded, or light wing, is not recommended.

4. Flared field landings are permitted with store loadings giving up to 12,500 foot-pounds of asymmetric moment. The minimum approach speed is 115 KIAS with up to 7500 foot-pounds of asymmetric moment, varying linearly thereafter to 130 KIAS at 12,500 foot-pounds.

AUTOMATIC FLIGHT CONTROL SYSTEM LIMITATIONS

At altitudes of 7500 feet and above, operation of the AFCS is unrestricted throughout the speed range of the aircraft (figure 1-63).

The automatic flight control system may be engaged below 7500 feet except for the following conditions:

1. During takeoff and landing.

2. Between 1000 feet and 7500 feet terrain clearance, with airspeed below 300 KIAS, AFCS operation requires the hands on the control stick. Above 300 KIAS, operation is unrestricted.

3. Below 1000 feet terrain clearance, to 200 feet terrain clearance. AFCS operation is restricted to hands on the control stick and a maximum airspeed of 500 KIAS.

4. The AFCS shall not be engaged below 200 feet above the terrain.

AFCS PERFORMANCE AND POWER LIMITATIONS

The attitude hold, preselect heading, and altitude hold modes all operate within the 60-degree pitch and 70-degree roll angle limits of the AFCS. It must be realized that within these limits, each mode is further limited by the attitude, gross weight, and power performance of the basic airframe.

ACCELERATION LIMITATIONS

Accelerations at which moderate buffeting occurs shall not be exceeded. Otherwise, the maximum permissible accelerations for flight are as shown on figure 1-61. As gross weight increases above 12,500 pounds, maximum permissible accelerations decrease as shown on figure 1-61. During conditions of moderate turbulence, avoid deliberate accelerations in excess of those permitted as shown on figure 1-61 to minimize the probability of overstressing the aircraft as a result of the combined effects of gust and maneuvering loads. Transonic pitchup can occur during speed reductions in the transonic region,

AIRSPEED LIMITATIONS

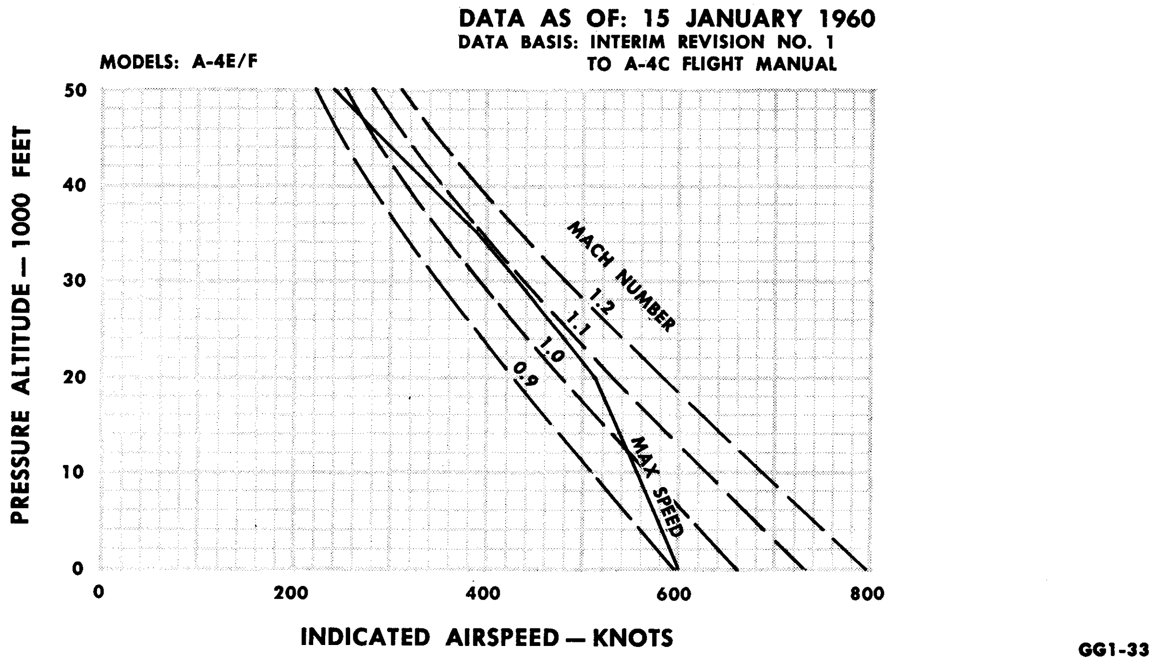


Figure 1-59. Airspeed Limitations

OPERATING FLIGHT STRENGTH DIAGRAM

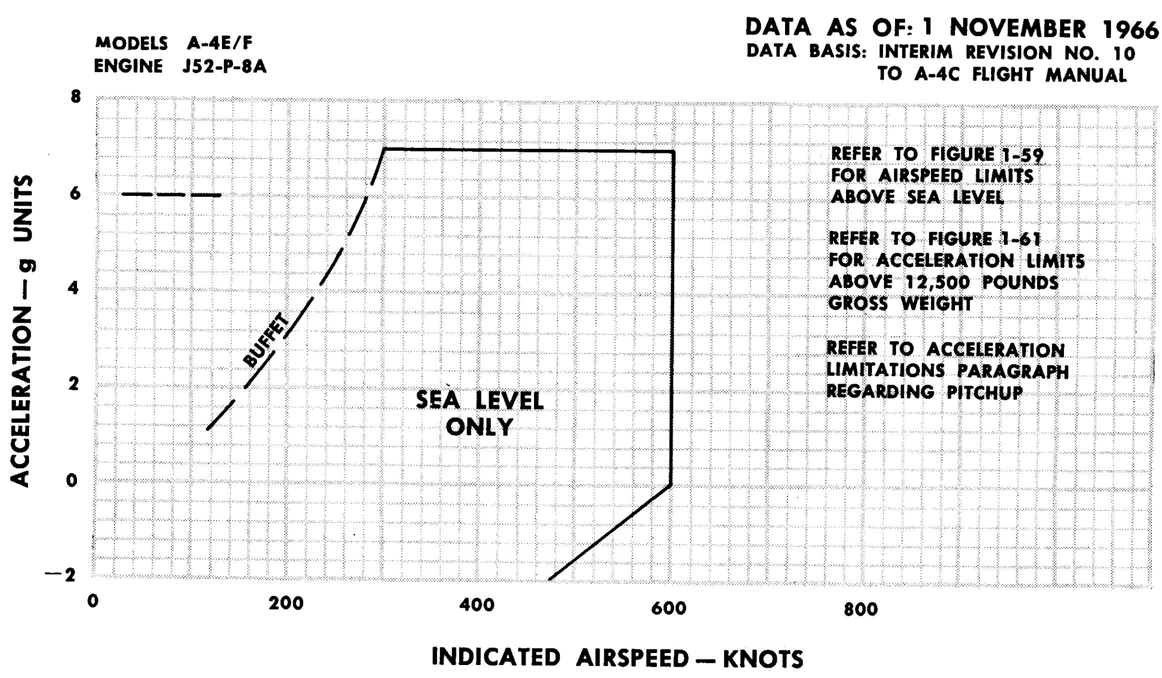


Figure 1-60. Operating Flight Strength Diagram

STRUCTURAL ACCELERATION LIMITS VS GROSS WEIGHT

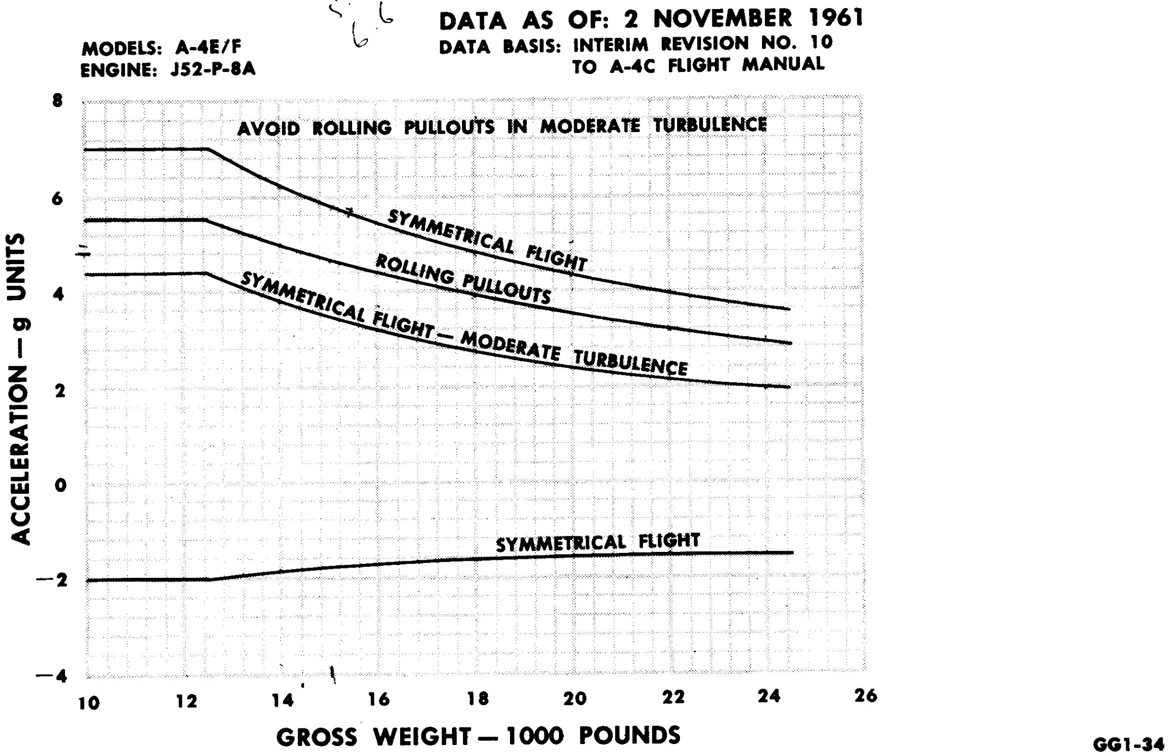


Figure 1-61. Acceleration Limits Versus Gross Weight

CROSSWIND VS AIRSPEED ABOVE MINIMUM

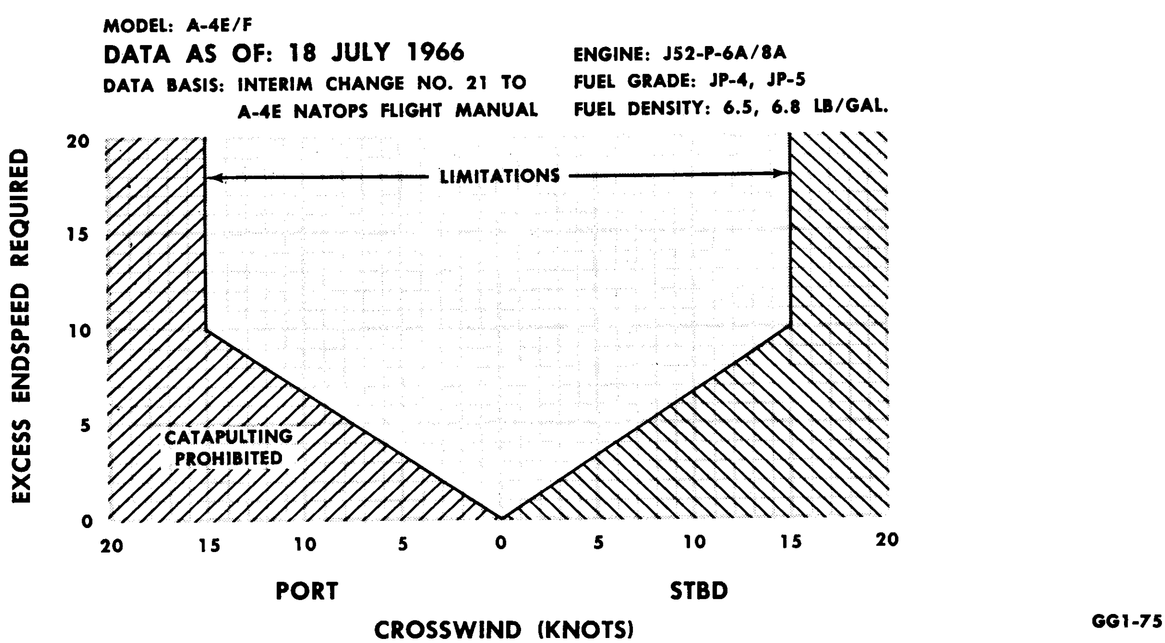


Figure 1-62. Catapult Launches with Asymmetric Loads Crosswinds vs Excess Endspeed Required

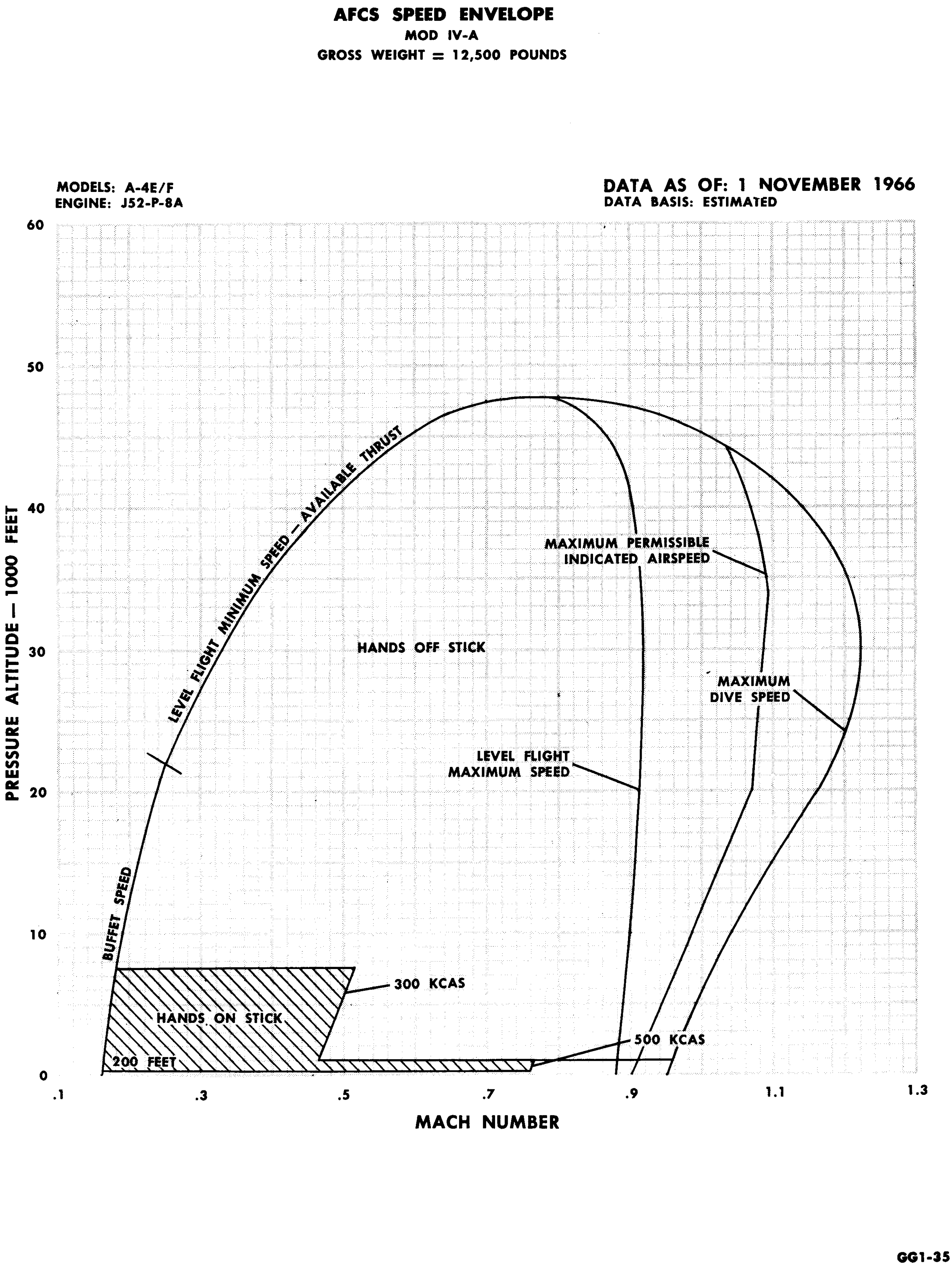


Figure 1-63. AFCS Speed Envelope

Buffet onset and flight strength limits at low altitude combat conditions are shown in section XI, part 9.

CAUTION

To minimize the probability of exceeding the maximum permissible load factor due to the combined effects of maneuvering load factor and transonic pitchup, the following procedure is recommended:

1. Below 15,000 feet, at speeds in excess of 0.94 IMN, avoid deliberate accelerations in excess of +4g.
2. Above 15,000 feet, avoid deliberate accelerations that exceed buffet onset.

PRESSURIZED WING TANK LIMITATIONS

The following restrictions are applicable to flight with the wing tank pressurized:

1. Aircraft velocity not to exceed 400 KIAS.
2. No catapulting.
3. No landings.
4. Coordinated turns only.
5. Aircraft load factor limits of +0.1 to +2.0.
6. No air refueling.
7. No nosedown attitudes.
8. 45-degree bank, maximum.

Tire Limit Speed

A maximum of 175 knots ground speed is imposed upon the aircraft during ground operations because of structural limits of the nosewheel tire.

SECTION II
INDOCTRINATION

TABLE OF CONTENTS

INTRODUCTION

This section establishes minimum requirements for training, initial qualification, and currency in specified areas. Subsequent sections provide the operational information considered necessary to ensure safe and efficient operation of the A-4/TA-4 when used in conjunction with the Naval Warfare Publications series. Unit commanders are authorized to waive, in writing to the individual affected, flight hour minimums and/or OFT/WST training requirements where recent experience in similar models warrants. However, adequate preparation and guidance of the pilot for the initial flight and subsequent flights, so that he safely attains and maintains a reasonable degree of proficiency in the operation of the A-4/TA-4, is of prime importance. Too often, under pressure of operational commitments, this groundwork is abbreviated or deleted. This can result only in a deterioration of individual and unit effectiveness. For this reason, commanding officers must continuously ensure adherence to these basic criteria whenever possible. Procedures for requesting waivers from the provisions of this section are contained in OPNAV Instruction 3510.9 (current revision).

Training requirements, checkout procedures, evaluation procedures, and weather minima for ferry squadeons are governed by OPNAV Instruction 3710.6 series.

GROUND TRAINING

Ground training should be continuous throughout the career of the A-4/TA-4 pilot. The overall syllabus will vary according to local conditions, facilities, directives from higher authority, and the unit commander's estimation of squadron readiness. However, there are certain specific requirements which must be met to ensure that the pilot is properly indoctrinated and briefed prior to flight.

Ground Training Requirements

Ground training and other related requirements for all pilots prior to familiarization flights in the A-4/TA-4 are as follows:

NOTE

Currently qualified A-4/TA-4 pilots need only comply with those portions of items 3, 4, and 6 below that pertain to differences in new model.

1. Current medical clearance.

2. Aviation physiological training as set forth in OPNAV Instruction 3740.3 (current revision).

3. NAMO Pilot Familiarization course (if available) or equivalent lectures by RCVW, operating A-4/TA-4 squadron, or other qualified personnel.

4. Lectures from RCVW operating A-4/TA-4 squadron, or other qualified personnel on the following subjects:

   a. Aircraft preflight, ground handling, hand signals, and normal flight procedures.

   b. Flight characteristics (including stalls and spins) and operating limitations.

   c. Use of safety and survival equipment and related procedures.

   d. Cockpit troubleshooting procedures.

   e. Emergency procedures.

f. Past aircraft accidents as an aid in preventing future accidents of like nature.

g. Local course rules, flying area, instrument procedures, and SAR facilities.

5. Blindfold cockpit check.

6. Minimum of 2 hours of flight and emergency procedures simulation in the OFT/WST within the 2-week period prior to the first familiarization flight. If OFT/WST is not available, a comprehensive oral and/or written examination on emergency procedures must be substituted.

7. Practice dry-run ejection accomplished in the RAPEC ejection seat in complete flight gear, utilizing both primary and alternate ejection handles.

8. Satisfactory completion of examinations on A-4/TA-4 operating limits, normal and emergency procedures, course rules, and aircraft systems.

9. Supervised aircraft preflight utilizing Daily Maintenance Requirement Cards, engine start, post-start checks using plane captain's signals, taxi, and securing engine.

10. Aviator's required reading pertinent to flight.

Ground Training Subjects

The following subjects should be included in the normal A-4/TA-4 squadron's ground training syllabus.

TECHNICAL TRAINING

1. NATOPS Flight Manual.
2. Auxiliary equipment.
3. Flight safety equipment.

MISSION TRAINING

1. Bombing and rocket theory and pipper control.
2. Glide bombing, rocket, and missile procedures.
3. Strafing procedures.
4. LABS equipment.
5. LABS/laydown delivery.
6. Patterns and procedures for local targets.
7. Close air support and GCBS procedures.
8. Pertinent publications in the NWP and NWIP series.
9. Special weapons.
10. Aviation ordnance.
11. Weapons loading.
12. High- and low-altitude navigation.
13. Radar and navigational computer operating procedures.
14. Aerial refueling.
15. Night flying.
16. MLP and carrier procedures.

INSTRUMENT TRAINING

1. Instrument flight (general).
2. Hand held computer. NEW
3. Airways navigation.
4. Local climbout and penetration.
5. GCA/CCA.
6. Special equipment.

FLIGHT SAFETY

1. AAR reviews.
2. Aircraft emergencies: practiced whenever possible in the OFT/WST. Where such a trainer is available, its use is mandatory during familiarization, and quarterly thereafter. In addition, a refresher flight or an oral or written review of emergency procedures is required after any layoff from flying in excess of 4 weeks.
3. Use of barricade/emergency field arresting gear.

INTELLIGENCE

1. Mission planning material.
2. Orders of battle.
3. Aircraft and ship recognition.
4. Escape and evasion.
5. Authentication procedures.

SURVIVAL

1. Physiological and medical aspects.
2. First aid.

3. Survival on land/sea.

4. Pilot rescue techniques.

Flight Qualifications

Minimum requirements for qualification and currency are set forth below for each phase of flight.

Command prerogative should be exercised to increase minimums when desired. Unit commanders are authorized to waive, in writing to the individual, these minimum requirements and/or OFT/WST training where recent experience in similar models warrants.

NOTE

Requirements listed for flight qualifications must be First Pilot time.

FAMILIARIZATION

1. Completion of the minimum ground training requirements prescribed earlier in this manual is required prior to flight.

2. Familiarization flight will be conducted in accordance with section IV, part 2.

3. Initial checkout flights will consist of a minimum of 5 hours.

INSTRUMENTS

Minimum requirements prior to actual instrument flight are as follows:

1. Ten hours in A-4/TA-4 aircraft in the last 6 months.

2. At least one A-4/TA-4 flight in the last 30 days.

3. Current instrument card.

4. Demonstration of instrument proficiency in assigned model.

WEAPONS AND MISSION TRAINING

Prerequisites for weapons and mission training are:

1. Completion of appropriate training set forth in preceding FAMILIARIZATION and INSTRUMENTS.

2. Minimum of 10 hours in A-4/TA-4 of which 5 hours must be within preceding 6 months.

3. For weapons delivery or mission training requiring a high-speed low-level run-in, a minimum of 15 hours in A-4/TA-4 aircraft within preceding 6 months of which 5 hours must be in model being flown.

4. Basic qualifications and currency requirements for various missions and weapons deliveries are set forth in OPNAV Instruction 03740.8 (current revision).

Minimum requirements prior to night weapons training are as follows:

1. Same as night-flying minimums, except 50 hours in A-4/TA-4 aircraft, and 10 hours in the last 30 days.

2. Day-proficient in type delivery in model being flown.

3. Familiar with target area and procedures.

4. Five hours night time in A-4/TA-4 of which one flight in model being flown must be within preceding 30 days.

NOTE

Ten hours during last 30 days may be waived for high-altitude horizontal bombing.

NIGHT FLYING

Minimum requirements prior to night flights are as follows:

1. Current instrument card.

2. Ten hours in A-4/TA-4 within the last 3 months.

FCLP AND CARRIER QUALIFICATION NEW

For day and night FCLP qualification the exact number of FCLP periods required depends on the experience and ability of the individual pilot, and will be determined by the unit commander. NEW

DAY FCLP. Minimum requirements prior to day FCLP are as follows: NEW

1. 10 hours in A-4/TA-4 aircraft and one flight in the last 30 days.

2. Familiarity with the slow-flight characteristics of the aircraft.

3. Proficiency in instrument flying in assigned model.

4. Proper briefing in day FCLP procedures. NEW

NIGHT FCLP. Minimum requirements prior to night FCLP are:

1. Demonstration of proficiency in day FCLP.

2. Five hours night time in the A-4/TA-4.

3. One A-4/TA-4 flight in the last 10 days; otherwise one day flight will be required prior to the night FCLP period.

4. Proficient in instrument flying in model assigned.

5. Proper briefing in night FCLP procedures.

DAY CARRIER. Minimum requirements prior to day carrier qualification are as follows:

1. Certification by Unit Commander as day field-mirror-landing qualified in model to be flown.

2. 50 hours in A-4/TA-4 aircraft.

3. Proper briefing in carrier landing, catapult, and deck procedures.

Minimum day qualifications are:

1. Two touch-and-go landings.

2. Ten arrested landings.

3. Two day CCA approaches from marshal point.

NIGHT CARRIER. Minimum requirements prior to night carrier qualifications are as follows:

1. Current day-carrier qualification in the model to be flown.

2. Ten hours night time within the last 6 months.

3. Certification by Unit Commander as night field-mirror-landing qualified in model to be flown.

4. Proper briefing in night carrier landing, catapult, and deck procedures.

5. A minimum of two satisfactory arrested landings shall be completed during the daylight hours preceding night qualification landings.

Minimum night qualifications are:

1. Six night arrested landings.

2. Two night CCA approaches from marshal point (to be conducted only after satisfactory completion of day CCA qualification).

For maintaining carrier qualifications, qualification is considered current for 6 months after the date of the last carrier landing in type. Refresher requirements to requalify are as follows:

1. Six to twelve months: four day and two night arrested landings.

2. Over 12 months: initial requirements, both day and night.

CROSS-COUNTRY FLIGHT

Minimum requirements prior to cross-country flight are as follows:

1. Current instrument card.

2. Fifteen hours in A-4/TA-4 to include 3.0 hours instrument time.

3. Flight packet, which includes security, accounting, servicing data, and accident forms.

4. Familiarity with aircraft servicing.

PERSONAL FLYING EQUIPMENT REQUIREMENTS

The flying equipment delineated in OPNAVINST 3710.7 shall be carried/worn on every flight. The following items not delineated in OPNAVINST 3710.7 series are also considered required flying equipment:

1. Integrated torso harness.

2. Approved light attached to torso harness.

3. Shroud cutter.

4. Other survival equipment appropriate to the climate or required by any unusual condition that may be peculiar to the area.

5. Survival transceiver if available.

All survival equipment will be secured in such a manner that it is easily accessible and will not be lost during ejection or upon landing.

 Pages 2-5 and 2-6 deleted.

10. Anti-g suit.

11. Integrated torso harness.

12. Latest type exposure suit available on all over-water flights when the water temperature is 59°F or below, or OAT is 32°F or below. During daylight, within gliding distance of land, exposure suit need not be required when the water temperature is above 50°F. Type commanders are authorized to waive the requirements for wearing all types of exposure suits if the possibility exists that high-ambient cockpit temperature could cause extreme debilitation through excess loss of body fluids.

13. Pistol with tracer ammunition for all over-water flights, night flights, and flights over sparsely populated areas. An approved signalling device is authorized as a substitute for the pistol when operational and/or security conditions warrant.

14. Approved light attached to torso harness.

15. Two-cell flashlight with red lens for all night and cross-country flights.

16. Shroud cutter.

17. Other survival equipment appropriate to the climate or required by any unusual conditions that may be peculiar to the area.

All survival equipment will be secured in such a manner that it is easily accessible and will not be lost during ejection or upon landing.

SECTION III
NORMAL PROCEDURES

TABLE OF CONTENTS

PART 1
BRIEFING/DEBRIEFING

BRIEFING

Briefings will be conducted using a prepared briefing guide and the appropriate mission card. The briefing shall cover those items pertinent to the specific mission assigned. Any format which is complete, concise, and orderly, and which can be readily used by the Flight Leader as a briefing guide is suitable. Each pilot will maintain a knee pad and record all data necessary to successively assume the lead and complete the assigned mission. This, however, does not relieve the Flight Leader of the responsibility for all pilots in the operation and conduct of the flight.

General

The briefing guide will include the following items, where applicable:

1. Aircraft assigned, call signs, event number, and deck spot

2. Succession to lead

3. Fuel load, stores, and aircraft gross weight.

4. Engine start, taxi, and takeoff times

5. Rendezvous instructions, takeoff distance and speed, and line speed.

MISSION

1. Primary

2. Secondary

3. Operating area/target

4. Control agency

5. Time on station or over target.

NAVIGATION AND FLIGHT PLANNING

1. Duty runway/predicted Foxtrot Corpen for launch and recovery, and position in the force

2. Climbout

3. Operating area procedures and restricted areas

4. Mission plan, including fuel/oxygen management and PIM

5. Bingo/low state fuel

6. Marshal/holding (normal and emergency)

7. Penetration procedures and minimums

8. Ship/field approach and runway lighting

9. GCA/CCA procedures and minimums, missed approach

10. Recovery: course rules, pattern, breakup, landing, and waveoff

11. Divert and emergency field/ready deck.

COMMUNICATIONS

1. Frequencies

2. Controlling agencies

3. Radio procedure and discipline

4. ADIZ procedures

5. IFF

6. Navigational aids

7. Hand/light signals.

WEAPONS

1. Loading

2. Arming

3. Special routes because of ordnance aboard

4. Pattern

5. Armament switches

6. Aiming point/sector setting

7. Run-in/entry airspeed

8. Minimum release/pull-out altitudes

9. G versus gross weight

10. Duds, hung ordnance procedures, dearming, jettison area

11. Safety

WEATHER

1. Local area, en route, and destination (existing and forecast)

2. Weather at alternate/divert fields

3. Winds, jet stream, temperature, and contrail band width.

EMERGENCIES

1. Takeoff aborts

2. Radio failure

3. Loss of NAVAIDS

4. Loss of visual contact with flight

5. Lost-plane procedures

6. Downed pilot and SAR

7. Aircraft emergency procedures and system failures.

AIR INTELLIGENCE AND SPECIAL INSTRUCTIONS

1. Friendly/enemy force disposition

2. Current situation

3. Targets

4. Safety precautions

5. Reports and authentication

6. Escape and evasion.

SAFETY PRECAUTIONS

DEBRIEFING

Each flight shall be followed with a thorough debriefing by the Flight Leader as soon as practical. All phases of the flight shall be covered, paying particular attention to those areas where difficulty was encountered and to the effectiveness of any tactics employed or weapons expended. To derive maximum benefit, constructive criticism and suggested improvements as to doctrine, tactics, and techniques should be given and received with the frankness, purpose, and spirit of improving the proficiency of the unit, as well as that of the individual pilot. When appropriate, it should include the individual debrief of each pilot by the LSO.

PART 2
MISSION PLANNING

MISSION PLANNING

The training objective is the orderly development of pilot techniques in preflight planning, climbout, high-altitude navigation and cruise control, air refueling, low-level navigation, and high-speed approaches to the delivery maneuver. The detailed specifics of these deliveries are set forth in A-4/TA-4 Tactical Manual (NAVAIR 01-1T). Mission turn radius chart is located in section XI, part 9 and 9A. A mission planning sample, section XI, part 10, is provided to assist the pilot in becoming familiar with the use of the performance section and to enable him to perform the assigned mission at the optimum conditions within the aircraft flight envelope.

PART 3
SHORE-BASED PROCEDURES

PRIOR TO FLIGHT

Preflight Checklist

EXTERIOR INSPECTION

Consult the Naval Aircraft Flight Record (yellow sheet) to determine the status of the aircraft; that it has been fully serviced with fuel, oil, liquid oxygen, compressed air, and hydraulic fluid. Inspect the exterior of the aircraft, proceeding as shown on figure 3-1.

Forward Fuselage (A)

1. Air refueling probe cover . . REMOVED
2. Air conditioning intake and exhaust ducts . . . . CLEAR
3. Static pressure vents (2 vents left side) . . . . CLEAR
4. Engine bleed static port (left side) . . . . CLEAR
5. Angle-of-attack vane cover . REMOVED
6. Rain repellent fluid level (gage under APX-64 coder access door (all A-4F) . . . . HALF TO FULL
7. Nose compartment panels . . CONDITION, SECURITY
8. Nose compartment cooling air inlet . . . . CLEAR
9. Static pressure vent (right side) . . . . CLEAR
10. Controls access panel . . . . . SECURE
11. Nosewheel well door . . . . . . CONDITION, SECURITY
12. Nosewheel steering assembly (all A-4F) . . . . CONDITION, SECURITY
13. Nosewheel strut . . . . EXTENSION, NO LEAKAGE
14. Nosewheel tire . . . . CONDITION
15. Nose gear downlock pin . . . . INSERTED
16. Emergency generator . . . . . RETRACTED, SECURE
17. External canopy jettison handle . . . . STOWED: ACCESS DOOR CLOSED
18. Gun flash suppressors and guns . . . . SECURE

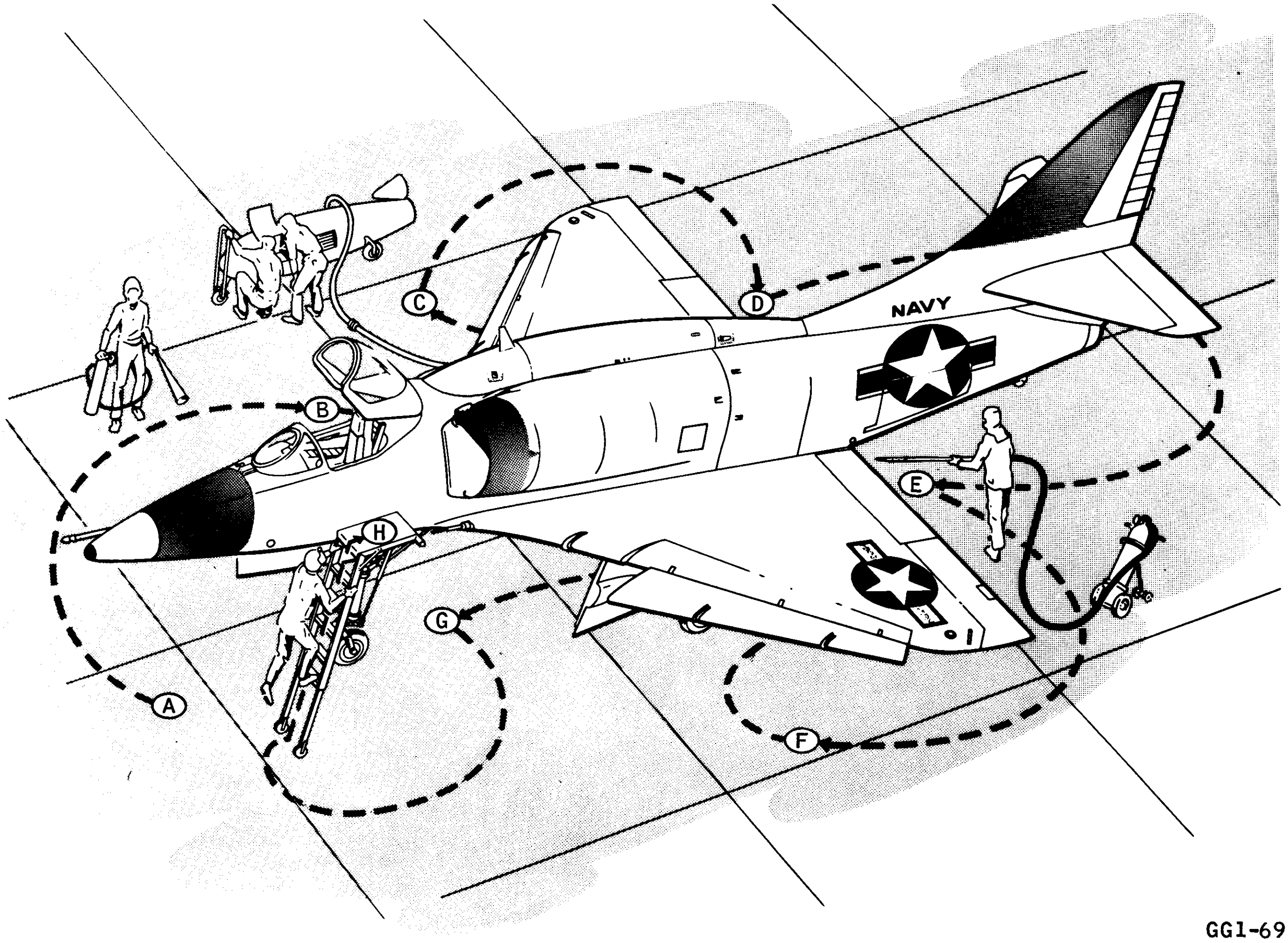


Figure 3-1. Exterior Inspection

19. Forward engine compartment . . . . CONDITION, SECURITY

20. Gear case oil drain line cap . LOCKWIRED

21. Guncharger pneumatic pressure gage . . . . CHECK

22. Aileron power package . . . . CHECK ALIGNING MARKS

23. Avionics pod . . . . CONDITION, SECURITY

24. Avionics plugs

a. Avionics pod duct plugs (3) (All A-4) . . . . REMOVED

b. Avionics pod bleed port plug (All A-4F) . . . . REMOVED

Right-Hand Wheel Well (B)

1. Main wheel well doors . . . CONDITION, SECURITY

2. Taxi light . . . . SECURITY

3. Gun pneumatic pressure gage . . . . 3200±200 psi

4. Armament safety disable switch . . . . SAFE

5. Catapult hook. . . . . PRELOAD, SECURITY

6. Main gear downlock pin . . . INSERTED

7. Main gear strut . . . . EXTENSION, NO LEAKAGE

8. Main wheel tire . . . . CONDITION

9. Brakes . . . . CONDITION, NO LEAKAGE

10. Fuel system vent . . . . . . CLEAR

Right-Hand Wing (C)

1. General condition . . . . . . WRINKLES, CRACKS, LOOSE RIVETS, FUEL DEPOSITS

2. Wing rack stores . . . . . . SECURE

3. Drop tank . . . . REMOVE FILLER-CAP, VISUALLY DETERMINE LOADING, REPLACE FILLERCAP

WARNING

Operate each slat by hand to make certain that each extends and retracts with negligible effort and without binding. Binding which causes asymmetric slat extension requires excessive lateral control deflection to maintain wings level after catapulting or during accelerated stalls and landing approaches.

4. Wing slat . . . . FREE MOVEMENT

5. Navigation and fuselage wing lights . . . . CONDITION

6. Aileron and wing flap . . . CONDITION, BONDING

7. Spoiler . . . . CONDITION, BONDING

8. Wing tank fillercap . . . . . SECURE

9. Fuselage tank fillercap . . . . SECURE

Aft Fuselage and Tail Section (D)

1. All access doors. . . . . . . CLOSED

2. Speedbrake . . . . CONDITION, SECURITY

3. Tailpipe cover . . . . REMOVED

4. Tailpipe . . . . CRACKS, WRINKLES, BURNS, FUEL DEPOSITS

5. Taillight. . . . . CONDITION

6. Rudder, elevator, and horizontal stabilizer . . . . CONDITION, BONDING

7. Speedbrake . . . . CONDITION, SECURITY

8. Arresting hook. . . . . RETRACTED AND LOCKED CONDITION

9. Tension bar retainer. . . . . CONDITION

10. Arresting hook hold-down cylinder pressure gage. . . . . 900±50 psi

11. Aft engine compartment. . . CONDITION, SECURITY

12. Drop tank fueling switch . . OFF

Left-Hand Wing (E)

1. Wing flap and aileron . . . . CONDITION, BONDING

2. Aileron tab . . . . CONDITION

3. Spoiler . . . . CONDITION, BONDING

4. Navigation and fuselage wing lights . . . . CONDITION

5. Wing . . . . WRINKLES, CRACKS, LOOSE RIVETS; FUEL DEPOSITS

6. Wing slat . . . . FREE MOVEMENT

7. Wing rack stores . . . . SECURE

8. Drop tank . . . . REMOVE FILLER-CAP; VISUALLY DETERMINE LOADING; REPLACE FILLERCAP

9. Approach lights and cover . . . . CONDITION

Left-Hand Wheel Well (F)

1. Main gear doors. . . . . CONDITION, SECURITY

2. Catapult hook. . . . . PRELOAD, SECURITY

3. Main gear downlock pin . . . INSERTED

4. Main wheel strut . . . . EXTENSION, NO LEAKAGE

5. Main wheel tire . . . . CONDITION

6. Brakes . . . . CONDITION, NO LEAKAGE

Center Fuselage Underside (G)

1. Fuselage rack store . . . . . SECURE

2. Centerline fuel tank . . . . . REMOVE FILLER-CAP; DETERMINE LOADING; REPLACE FILLERCAP

3. Forward engine and accessories section access doors . . . . CLOSED

4. Link and case ejection chutes . . . . CLEAR

Cockpit Area (H)

1. External canopy jettison handle . . . . STOWED; ACCESS DOOR CLOSED

2. Controls access panel . . . . SECURE

3. Angle-of-attack vane . . . . CONDITION, FREE MOVEMENT

4. Engine intake plugs . . . . . REMOVED

5. Intake ducts . . . . FREE OF FOREIGN OBJECTS

6. Canopy cover . . . . REMOVED

7. Pitot tube cover . . . . REMOVED

8. Total temperature sensor cover . . . . REMOVED

9. Canopy surface and seal . . CONDITION

ESCAPAC I EJECTION SEAT PREFLIGHT

1. Rocket seat control safety handle (headknocker) . . . . DOWN

2. Canopy air bungee cylinder gage . . . . 2500 PSI OR PER INSTRUCTION PLATE ON BUNGEE

3. Ensure that bungee trigger is parallel to centerline of aircraft . . . . IF APPLICABLE

WARNING

On aircraft equipped with aft initiator instead of bungee trigger mechanism, ensure that initiator safety pin is installed before checking canopy jettison control cable attached from seat to emergency jettison box.

4. Cable from jettison control pulley to canted bulkhead . . . . . . CONNECTED

5. Canopy seat interlock . . . . CONNECTED

6. Catapult firing cable from pulley mechanism to disconnect housing . . . . ENGAGED

7. Ejection seat catapult safety pin and two canopy jettison initiator pins . . . . REMOVED

8. Harness release actuator pin . . . . NOT VISIBLE

9. Seat separation nitrogen bottle . . . . INSTALLED

10. Emergency oxygen . . . . . . 1800 PSI

11. Lap belt secure . . . . HARD PULL

12. Shoulder harness secure . . LOCKING PIN VISIBLE

13. Zero-delay lanyard . . . . . . CONNECTED

14. Face curtain and alternate handles . . . . STOWED

15. Emergency harness release handle stowed and parachute cable secured . . . . CHECK

ESCAPAC IA-1 EJECTION SEAT WITH DART SYSTEM PREFLIGHT (Reworked per A-4 AFC 359)

1. Ejection seat control safety handle (headknocker) . . . . DOWN

2. Canopy air bungee cylinder pressure gage . . . . PER INSTRUCTION ON BUNGEE

3. Cable to jettison control pulley in canted bulkhead (Not reworked per A-4 AFC 432). . . . ENGAGED

4. Canopy seat interlock cable . . . . ENGAGED

5. Canopy bungee trigger aligned . . . . IF APPLICABLE

6. Ejection seat catapult safety pin and two canopy jettison pins . . . . REMOVED

7. Emergency oxygen lanyand . . . . CONNECTED

8. DART system lanyard. . . . CONNECTED

9. Emergency oxygen bottle . . 1800 PSI

10. Harness release actuator pin. . . . . NOT VISIBLE

11. Face curtain and alternate handles . . . . STOWED

12. Emergency harness release handle stowed and parachute arming cable secured . . . . CHECK

13. Shoulder harness secured . . . . LOCKING PIN VISIBLE

14. Lap belt secure . . . . LOCKING PINS VISIBLE

15. NB-11 parachute . . . . INSTALLED

ESCAPAC IC-3 EJECTION SEAT PREFLIGHT

1. Ejection seat control safety handle (headknocker). . . . DOWN

2. Canopy air bungee cylinder pressure gage . . . . PER INSTRUCTION ON BUNGEE

3. External canopy jettison system initiator. . . . . SAFETY PIN REMOVED

4. Ejection seat catapult pin block assembly and one canopy jettison initiator pin . . . . REMOVED

5. Emergency oxygen lanyard. . . . . CONNECTED

6. DART system lanyard. . . . CONNECTED

7. Emergency oxygen bottle . . 1800 PSI

8. Canopy seat interlock cable . . . . CONNECTED

9. Face curtain and alternate handles . . . . STOWED

10. Emergency harness release handle stowed and parachute arming cable secured . . . . CHECK

11. Shoulder harness secure . . LOCKING PIN VISIBLE

12. Lap belt secure . . . . LOCKING PINS VISIBLE

13. Zero-delay lanyard . . . . . CONNECTED

INTERIOR INSPECTION

Check the general appearance of the cockpit, and make sure that all gear is properly stowed and secure. Make proper harness, oxygen, radio, and antiblackout connections, and perform the following checks before starting the engine:

CAUTION

Upon entering the cockpit, make certain that the landing gear handle is DOWN and that the hose jettison switch (tanker only) is OFF (forward).

1. Expose suit blower . . . . . . OFF

2. Emergency speedbrake knob . . . . NORMAL

3. Antiblackout suit blower, and oxygen-radio hoses . . . . CONNECT TO CONSOLE

4. Oxygen switch . . . . ON, CHECK FLOW, THEN OFF

4a. Radar Beacon . . . . OFF

5. AFCS standby switch. . . . . OFF

6. AFCS aileron trim switch . . . . NORM

7. Emergency fuel transfer switch . . . . OFF

8. Air refueling fuselage only switch (A-4F) . . . . NORM

9. Drop tanks switch. . . . . . . OFF

10. Radar selector switch (Reworked per A-4 AFC 387) . . . OFF

11. Engine starter switch . . . . PULLED UP

12. Fuel control switch. . . . . . PRIMARY

13. Manual fuel shutoff control lever . . . . NORMAL (GUARD DOWN)

14. Smoke abatement switch . . OFF

15. JATO arming-switch . . . . SAFE

16. JATO jettison switch . . . . SAFE
17. Throttle . . . . OFF
18. Speedbrake switch . . . . . . CLOSE
19. Master exterior lights switch . . . . OFF
20. Flap handle . . . . UP
21. Spoiler switch . . . . OFF
22. Nosewheel steering switch . . . . NORM
23. Throttle friction wheel . . . AS DESIRED
24. RADAR WARN/OFF switch (Reworked per A-4 AFC 394) . . . . OFF
25. Accelerometer . . . . PUSH TO RESET
26. Airspeed indicator . . . . . . 0, SET
27. Vertical velocity 0
indicator 0
28. Gunsight . . . . SET, LOCK
29. Radar altimeter . . . . OFF
30. Emergency stores jettison select switch . . . . AS DESIRED
31. All armament switches . . . OFF
32. Audio bypass switch . . . . . NORM
33. Emergency handles . . . . . STOWED
34. Arresting hook handle . . . . UP
35. Navigation computer . . . . . SET
36. UHF function switch . . . . . OFF
37. TACAN . . . . OFF
38. IFF master switch . . . . . . OFF
39. AN/APR-25(V) (Reworked per A-4 AFC 394) . . . . OFF
40. Radar selector switch (Not reworked per A-4 AFC 387) . . . . OFF
41. SIF controls (A-4E) . . . . . SELECT CODE
42. Compass controller . . . . . SLAVED, LATITUDE SET
43. Interior lights control panel . . . . ALL SWITCHES OFF
44. Emergency generator bypass switch . . . . NORMAL
45. TACAN antenna switch . . . AS DESIRED
46. Spare lamps container . . . ADEQUATE SUPPLY
47. Rain removal switch . . . . . OFF
48. Engine anti-icing switch . . OFF
49. Temperature knob . . . . . . AS DESIRED
50. Cabin pressurization switch . . . . NORMAL
51. Windshield defrost switch . . . . HOLD
52. Exterior lights control panel . . . . ALL SWITCHES OFF
53. Preflight check the thermal radiation closure.

WARNING

Make certain the ejection seat safety handle is stowed and locked in the full UP position before flight.

Before Starting the Engine

Ascertain that the areas forward and aft of the aircraft are clear of personnel and loose objects. See figure 1-54 for danger areas. Make certain that fire fighting equipment is available and manned.

Starting the Engine

An electrical power supply of 115 vac for ignition and a source of starter air is required for ground starting the engine. The two methods of starting the engine are pilot-controlled and ground-controlled starts.

PILOT-CONTROLLED STARTS

Pilot-controlled starts should be made whenever possible, to avoid starter motor overspeed. The time delay inherent in initiating or shutting off the starter air, when using hand signals, makes the ground-controlled start less desirable.

CAUTION

Starter motor overspeed can be severe enough to cause starter motor damage or failure with a resultant hazard to personnel and equipment.

To provide automatic air supply shutoff at the correct starter cutout speed, the aircraft starter circuit receptacle must be connected to the gas turbine power unit prior to starting attempts. The ground air supply shuts off automatically at approximately 50 percent rpm unless a malfunction occurs, in which case the air supply must be shut off manually by pulling up on the engine starter switch (start-abort). The engine should be started as follows after application of air/external power:

1. Throttle . . . . OFF
2. Engine starter switch . . . . DEPRESS TO START
3. 5 percent rpm, throttle . . . IGN
4. 15 percent rpm, throttle . . IDLE
5. Stabilized idle rpm . . . . . . 50 TO 60.2 PERCENT RPM

Light-off should occur within 15 seconds after the throttle is moved outboard to start the ignition cycle and is indicated by a rise in EGT after the throttle is moved to the IDLE position. If light-off does not occur within 15 seconds, retard the throttle to OFF, pull up the engine starter switch, and investigate. Normally, the engine should be stabilized at IDLE rpm within 30 seconds after depressing the engine starting button.

GROUND-CONTROLLED STARTS

In most cases pilot-controlled starts are not possible, and the following procedure must be used:

1. Throttle . . . . OFF
2. One finger held vertically . . . . START GTC

After Plane Captain signals the GTC is up to speed:

3. Two fingers held vertically . . . . P/C OPEN GTC AIR VALVE
4. 5 percent rpm, throttle . . . IGN
5. 15 percent rpm, throttle . . . . IDLE
6. 45 percent rpm . . . . P/C CLOSES GTC AIR VALVE
7. Stabilized idle rpm . . . . . . 50 TO 60.2 PERCENT RPM

Light-off should occur within 15 seconds after the throttle is moved outboard to start the ignition cycle and will be indicated by a rise in EGT after the throttle is moved to the IDLE position. If light-off does not occur within 15 seconds retard the throttle to OFF, signal the P/C to close the GTC air valve, and investigate. Normally, the engine should be stabilized at IDLE rpm within 30 seconds after the P/C opens the GTC air valve.

8. 45 percent rpm, three fingers held vertically . . . . P/C CLOSE GTC AIR VALVE

AFTER ENGINE LIGHT-OFF

If light-off is satisfactory and engine speed is stabilized with the throttle at IDLE using either of the above methods, check the following:

1. Rpm . . . . IDLE (50 TO 60.2 PERCENT RPM)

NOTE

See figure 3-2 for IDLE rpm vs temperature relationship.

2. EGT . . . . 200° TO 340°C

NOTE

At IDLE rpm, the temperature pointer will normally stabilize at a position below the maximum indicated. 340°C is not a limit, but a guide to indicate the EGT which, if exceeded, may signify an engine malfunction.

3. Fuel boost . . . . LIGHT OUT

4. Oil pressure . . . . 35 TO 50 psi

NOTE

If the oil pressure reads low (below 35 psi) at IDLE rpm, increase rpm slightly to 60 percent. If normal pressure is not indicated at this higher rpm, shut down the engine and determine the reason for the lack of, or low, oil pressure indication.

5. Oil quantity indicator/switch . . . . LIGHT OUT

NOTE

- Due to oil system drainage, the oil quantity light may be on prior to starting the engine and remain on after start. If oil pressure is within limits, add power to 75 percent, quantity light should go off within approximately 8 minutes.

- When usable oil level is between 20 and 80 percent, the oil quantity indicator light will only come on when the indicator/switch is pressed. When usable oil level is 20 percent or less, the light will come on automatically.

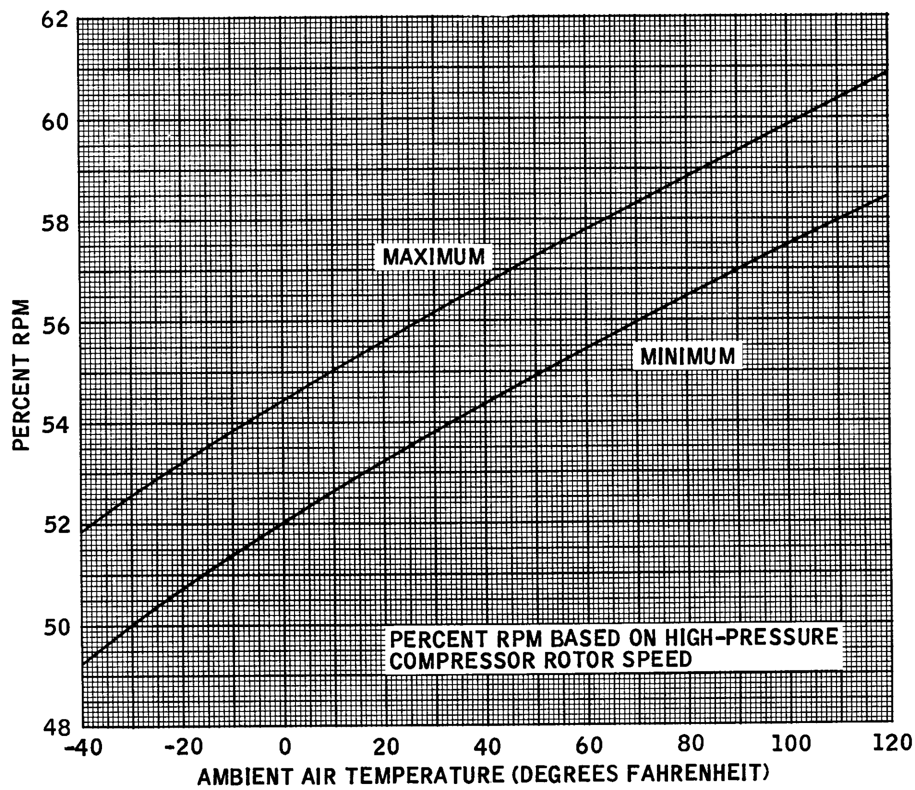
CHUGS AND STALLS

If chugging is encountered during an acceleration, there will be a momentary rpm hesitation without an exhaust temperature rise. Engine stall may or may not be accompanied by chugging. If a stall does occur, the rpm will hang up or decrease and the exhaust gas temperature will rise. Should either a chug or a stall occur, shut down the engine and investigate.

ENGINE IDLE CHECK CURVE - J52-P-6A

MODELS A-4E/F

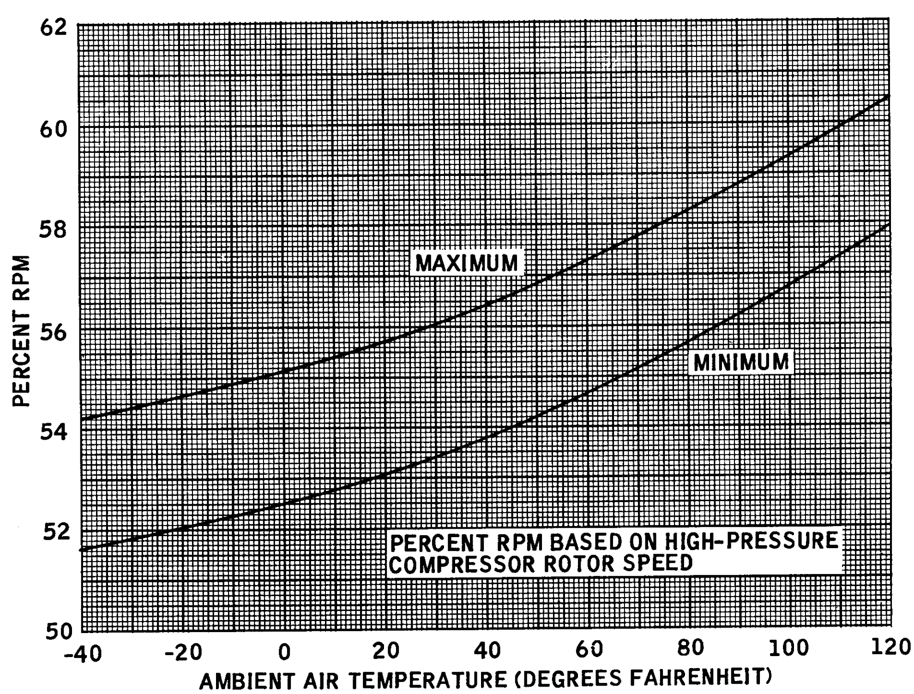
DATA AS OF: 9 September 1966
DATA BASIS: Contractors Trim Curve



ENGINE IDLE CHECK CURVE - J52-P-8A

MODELS A-4E/F

DATA AS OF: 9 September 1966
DATA BASIS: Contractors Trim Curve



GG1-27

Figure 3-2. Engine Idle Check Curve

Engine Ground Operation

No warmup period is necessary. Always use the minimum rpm necessary to minimize the possibility of foreign object damage.

CAUTION

Be extremely cautious if passing objects to or from ground crewmen with engine operating. This practice has proved dangerous in causing ingestion of foreign objects into the engine and subsequent damage to blading.

EQUIPMENT WARMUP TIME AND OPERATING LIMITATIONS

Warmup time and operating limitations for the listed electronic equipment is as follows:

Effectivity: All A-4E aircraft

Item	Warmup
AN/ARC-27A	(Note)1 minute
AN/ARA-25	(Note)1 minute
AN/ARN-52(V)	3 minutes
AN/APX-6B	(Note)1 minute
AN/APA-89	1 minute
AN/ASQ-17B	(Note)1 minute
AN/ASN-19A/41	None/2 minutes
AN/AJB-3/3A	70±10 seconds
AFCS	30 seconds
AN/APG-53A	3 minutes
AN/APN-153(V)	5 minutes
AN/APR-25(V) (A-4 AFC 394)	3 minutes

Effectivity: All A-4F aircraft

Item	Warmup
AN/ARC-51A	3 minutes
AN/ARR-69	3 minutes
AN/ARA-50	3 minutes
AN/ARN-52(V)	3 minutes
AN/APX-64	3 minutes
AN/ASN-41	2 minutes
AN/APN-141	1 minute
AN/AJB-3A	70±10 seconds
AFCS	30 seconds
AN/APG-53B	3 minutes
AN/APN-153(V)	5 minutes
AN/APR-25(V) (A-4 AFC 394)	3 minutes

NOTE

Thirty minutes ground limitation, without air conditioning.

Poststart Checklist

When electrical power becomes available after starting the engine, check the following items:

1. UHF function switch . . . . TR + G
2. IFF master switch . . . . STBY

NOTE

Effectivity: All A-4E aircraft

The IFF master switch must be moved from the OFF position for operation of the UHF remote channel indicator.

3. TACAN switch . . . . REC

CAUTION

Remain in REC for 3 minutes before going to the T/R position.

4. AFCS . . . . STANDBY
5. Fuel control light . . . . OFF
6. Depress master TEST switch to check angle-of-attack index light, LAWS, LABS, WHEELS, FIRE, OBST, ladder caution lights, pilot advisory, armament advisory, radar altimeter and OIL LOW lights, fuel quantity indicating circuits, and oxygen low-level warning light. The fuel quantity indicator will rotate to zero while the liquid oxygen indicator will rotate counterclockwise with warning light on, if less than 1 liter of liquid oxygen remains.

NOTE

- On aircraft reworked per A-4 AFC 345, the LAWS, LABS, WHEELS, OBST, and FIRE warning lights will actuate simultaneously from the master TEST switch. On aircraft not reworked per A-4 AFC 345, the LAWS, LABS, WHEELS, OBST, and FIRE warning lights must be individually pressed.
- On aircraft reworked per A-4 AFC 356, the IFF MODE 4 light will also come on when the master TEST switch is activated.

7. LABS light . . . . push to test
8. LOX quantity . . . . note
9. Fuel quantity . . . . check INT/EXT readings

10. Oil quantity indicator/ switch . . . . PRESS TO TEST, LIGHT OUT
11. Attitude gyro indicator . . . . . OFF FLAG DISAPPEARS (WITHIN 70±10 SECONDS)
12. Compass controller panel . . . SET
13. Standby gyro . . . . ERECT, OFF FLAG NOT VISIBLE
14. Rain removal system . . . . . . CHECK FOR FLOW, THEN OFF
15. AFCS. . . . . OFF AFTER CHECKS COMPLETED

Additional checks and hand signals for use between pilot and plane captain for starting and poststart checks are contained in figure 7-2. These signals have been designed to work equally well, whether shore-based or carrier-based, and in daylight or darkness. During night operations, extreme care must be taken to be positive with all signals. In this regard, when using the flashlight to illuminate a hand which is giving a signal, always direct the flashlight away from the person being signalled.

PRIOR TO TAXIING

1. Altimeter . . . . SET, NOTE ERROR
2. Clocks . . . . SET, RUNNING
3. Pressure ratio . . . . SET FOR AMBIENT TEMPERATURE (SEE FIGURE 3-3.)

TAXI

When ready to taxi, signal the plane captain to remove chocks. Advance throttle to about 70 percent before releasing the brakes. Release brakes and, when the desired taxi speed is reached, retard throttle to IDLE. Use caution in confined or restricted areas. Nosewheel steering (A-4F) may be used with brakes as necessary for directional control.

NOTE

With spoiler switch in ARMED position, the spoilers will be open as long as throttle position is below 70 percent setting.

To avoid foreign object damage to engines, pilot shall maintain a minimum taxi interval of 200 feet, or taxi in close formation with wing-tip clearance and intakes clear of leader's exhaust. While taxiing, determine that nose strut is not overinflated by observing that nose strut will compress when brakes are applied firmly. Check standby compass swinging free and adequate fluid level; turn indicator deflecting normally. The oxygen mask should be donned while taxiing when the canopy is closed and the pressurization is on.

CAUTION

Do not taxi with the canopy open at speeds which, coupled with headwinds, cause the relative wind to exceed 60 KIAS. If taxiing with the canopy closed, be sure it is completely latched. Taxiing with the canopy partially open and the canopy control handle in the locked position imposes shear forces on the canopy hinges which exceed their safe design limits, and may cause fractures of the hinge structure.

Pretakeoff Checklist

Before takeoff, complete the following checks: Perform manual fuel control check:

1. Throttle . . . . 85 PERCENT RPM
2. Fuel control . . . . MANUAL
3. Fuel control light . . . . . ON, AND ENGINE INDICATION THAT SWITCHOVER HAS OCCURRED
4. Fuel control . . . . PRIMARY
5. Fuel control light . . . . . OFF

Referring to the TAKEOFF checklist (figure 3-4) check:

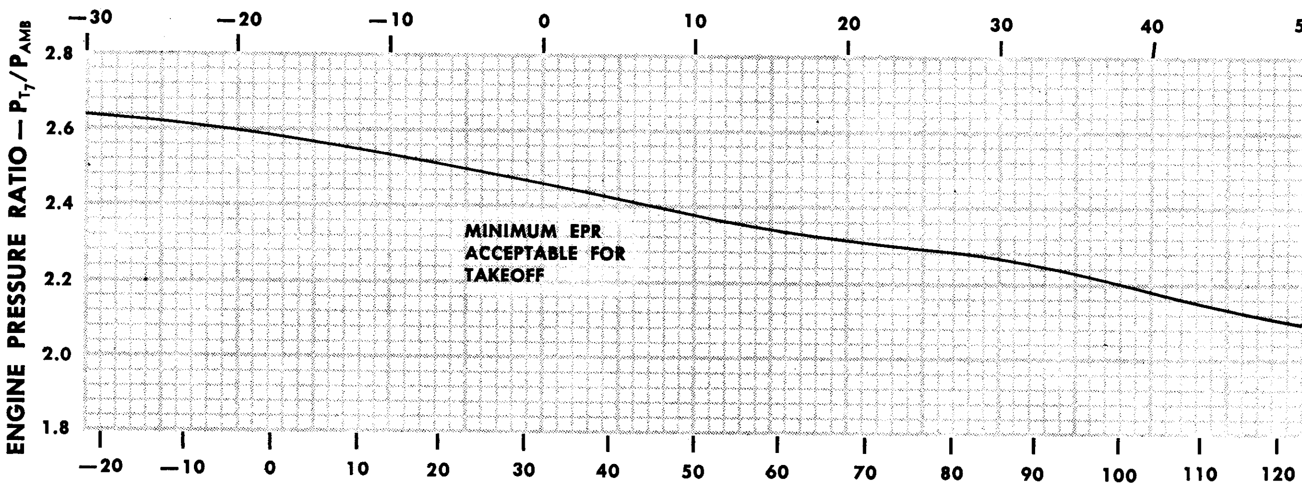
1. Trim
   - Aileron . . . . STICK CENTERED, TAB FAIRED ±1/5 INCH
   - Rudder . . . . 0°
   - Elevator (Field). . . . . 8° UP/CATAPULT AND JATO AS REQUIRED
2. Harness . . . . SHOULDER HARNESS LOCKED
3. Canopy. . . . . HANDLE OVER-CENTER, CANOPY HOOKS ENGAGED IN ROLLERS

NEW

TAKEOFF PRESSURE RATIO

MODEL: A-4E
ENGINE: J52-P-6A

DATA AS OF: 21 NOVEMBER 1963
DATA BASIS: CONTRACTORS TRIM CURVE



MODEL: A-4E/F
ENGINE: J52-P-8A

DATA AS OF: 1 NOVEMBER 1966
DATA BASIS: CONTRACTORS TRIM CURVE

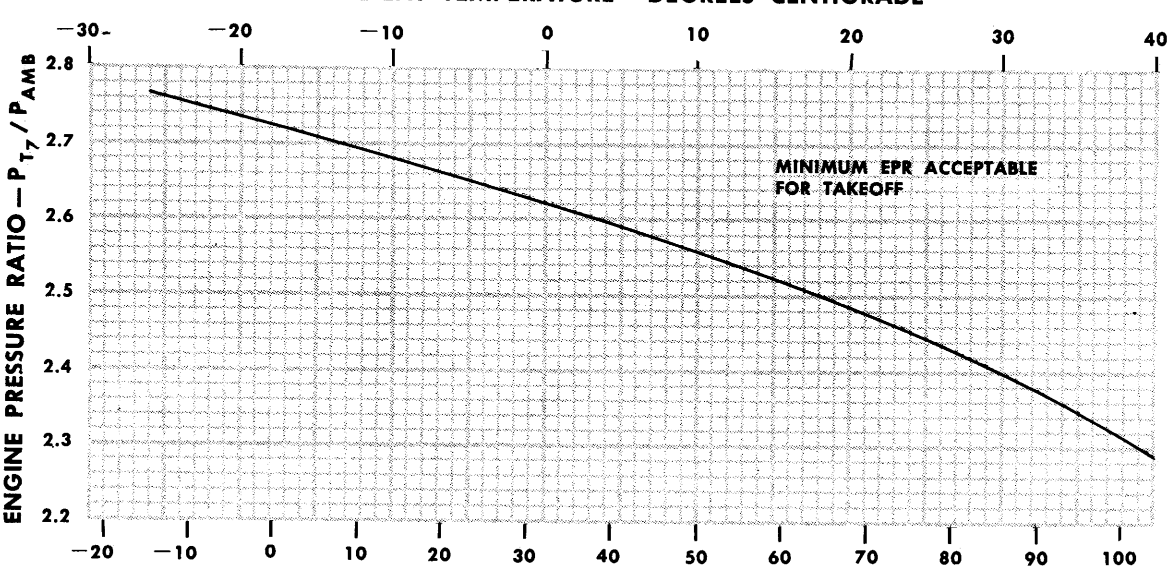


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Figure 3-3. Takeoff Pressure Ratio Charts

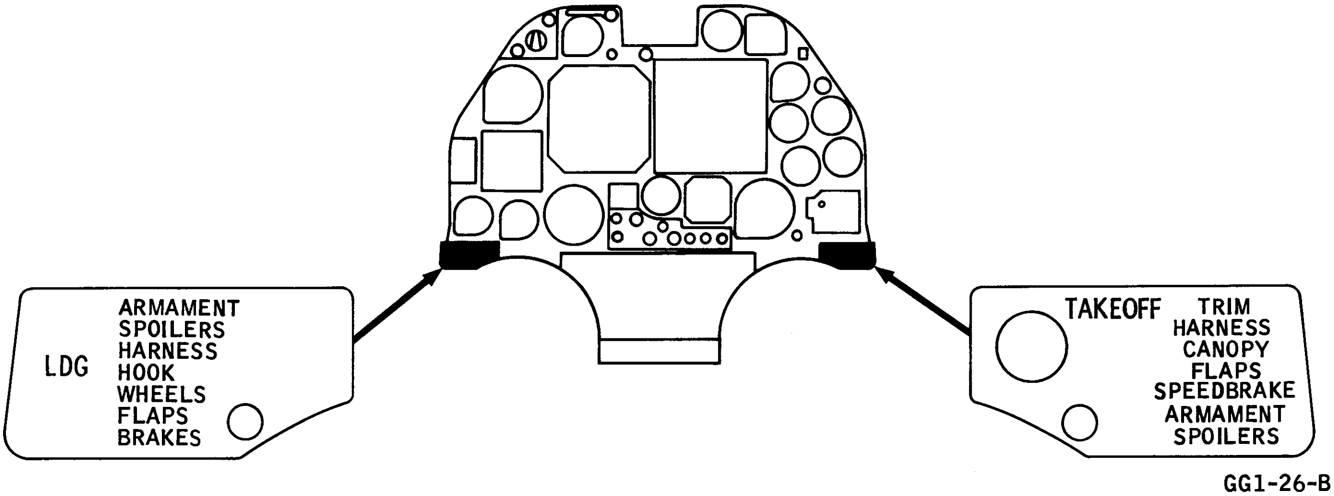


Figure 3-1. Takeoff and Landing Checklist

WARNING

Do not operate any hydraulically operated equipment while plane captain is not in sight.

4. Flaps . . . . SET AT 1/2
5. Speedbrakes . . . . CLOSED
6. Spoilers . . . . as desired (If ARMED, closed – power 70 percent or above)
7. Armament . . . . all switches off. emergency selector switch appropriate setting

NOTE

Before takeoff, it is recommended that the cabin temperature control knob be positioned in the middle of the WARMER range and all of the defrost air diverted to the foot-warmers. Direct the "eyeball" diffusers away from the face.

WARNING

Make certain the ejection seat safety handle is stowed and locked in the full up position before flight.

TAKEOFF

Takeoff Procedures

Upon completion of the pretakeoff checklist and after receipt of clearance from the tower, the aircraft will line up on the runway. Each pilot should check adjacent aircraft for correct trim settings, flap position, canopy closed, speedbrakes closed, spoilers closed, no fuel or hydraulic leaks, and ejection seat safety handle up. Half-flaps should be used for takeoff during normal shore-based operations. Each pilot shall indicate his readiness for takeoff by giving a "thumbs-up" up the line. (See figure 3-5 for typical takeoff diagram.)

NOTE

The amount of nose gear strut extension has no significant effect on lift-off speed, control forces, or trim position required. Refer to section XI for additional information on take-off airspeed and ground roll distance.

As the engine accelerates through 90 percent, release brakes to prevent skidding the tires. Ensure that acceleration is within acceptable limits and that engine accelerates smoothly. When engine stabilizes initially, check for minimum T.O. pressure ratio (EPR), EGT, and RPM.

NOTE

Wind has a negligible effect on EPR readings.

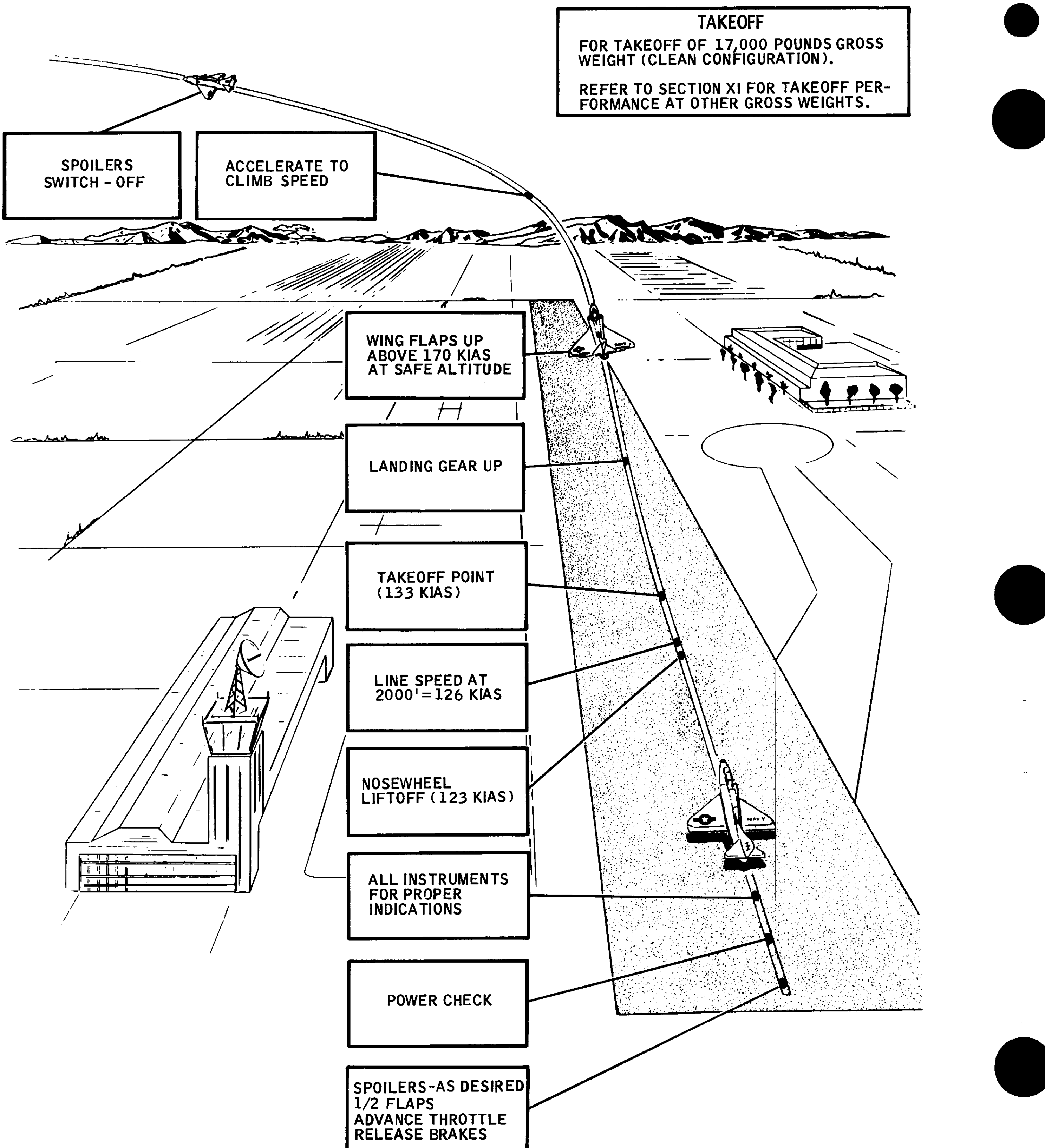


Figure 3-5. Takeoff Diagram

Use brakes (A-4E) or nosewheel steering (A-4F) to maintain directional control until rudder becomes effective (about 70 KIAS).

NOTE

Effectivity: All A-4F aircraft

If nosewheel steering is used, it shall be engaged prior to brake release.

On rough runways, nosewheel bounce may be experienced. Apply forward stick as necessary to maintain nosewheel on the deck. Check the predicted line speed at selected distance marker. This check point should be selected so as to allow normal braking technique to stop the aircraft on the runway remaining. Ten knots prior to predicted takeoff speed, raise the nose to a takeoff attitude and allow aircraft to fly itself off the deck. After comfortably airborne, retract landing gear and apply brakes momentarily to stop main gear tire rotation before wheel enters wheel well. Raise the flaps at 170 KIAS or above.

For a single takeoff, the centerline of the runway should be used as a directional guide.

During formation takeoff (maximum of two aircraft), the leader should take position on the downwind side of the runway. Lateral separation shall be ensured to minimize danger of collision should a lead aircraft blow a tire or abort. For formation takeoffs with two sections, one section shall be airborne before the next section commences takeoff roll. Formation takeoffs are not permitted with dissimilar-type aircraft nor with a crosswind component in excess of 8 knots.

Where individual takeoffs are made with a flight of two or more aircraft, the flight leader shall take position on the downwind side of the runway. Each pilot shall, after lineup on the runway, check adjacent aircraft for correct trim settings, flap position, canopy closed, speedbrakes closed, spoilers closed, no fuel or hydraulic leaks, and ejection control ground safety handle up. Each pilot shall indicate his readiness for takeoff by giving a "thumbs-up" up the line. The second aircraft shall commence takeoff roll not less than 10 seconds behind the first aircraft. The pilot will inform the tower immediately by radio if takeoff is aborted.

CROSSWIND TAKEOFF

If strong crosswinds exist, takeoff along upwind side of runway and apply forward stick as necessary to hold nosewheel on deck until computed takeoff speed is reached. Deflect stick into wind as necessary to maintain lateral control. Use brakes or nosewheel steering (A-4F) to maintain directional control until rudder becomes effective (about 70 KIAS). It is recommended that the spoilers be armed prior to releasing the brakes so they will be immediately available in the event of a takeoff abort.

CAUTION

- Excessive forward stick pressure may cause a blown nose tire during takeoff roll.
- Takeoffs are not recommended with a 90-degree crosswind component in excess of 25 knots. When spoilers are not available, takeoffs are not recommended when the crosswind component exceeds 15 knots at 90 degrees.

NOTE

Almost constant trimming of the horizontal stabilizer will be necessary after takeoff during the period of acceleration to best climbing speed.

Be prepared for the possibility of unusual noise or vibration during the first minute after takeoff, caused by an unbalanced nosewheel tire. An unbalanced nosewheel tire creates a strong vertical vibration of decreasing frequency which can be sensed to emanate from the nose section. DON'T assume that this is the case if unusual noises occur after takeoff. DO analyze engine instruments and feel of aircraft. Be prepared to take action unless noise/vibration ceases as indicated above.

Minimum Run Takeoff

To accomplish a minimum run takeoff, full noseup trim and half-flaps should be employed.

NOTE

Use of full-flaps delays nosewheel lift-off.

After brake release, as the aircraft accelerates down the runway, a generous amount of aft stick should be used to effect nosewheel lift-off. During aircraft lift-off, (about 10 KIAS less than normal), a noseup rotation of the aircraft will occur, which will require an immediate reduction in aft stick pressure to control. As the aircraft accelerates to climbing speed after takeoff, almost constant retrimming of the stabilizer will be necessary. The noseup rotation of the aircraft at takeoff is reduced in abruptness and severity by an increase in gross weight or by use of less aircraft noseup trim. However, if less than full-noseup trim is employed, the effect will be to increase the minimum nosewheel lift-off speed about 4 knots and increase the takeoff run approximately 300 feet for each 2 degrees of reduced noseup trim.

IN-FLIGHT

Refer to Section IV.

BRAKING TECHNIQUES

Brake pedals should be pumped on final approach to ensure a firm brake pedal after touchdown. As a general technique, a steady pedal pressure should be applied and maintained during landing rollout. Brake pedals should be released and reapplied only as necessary to hold firm pedal pressure and position.

CAUTION

The improved capacity of the dual disc brakes (all A-4F aircraft; all A-4E aircraft after rework per A-4 AFC 272) makes it possible to lock the wheel brakes at any speed, causing a tire to blow.

Proper braking technique for a minimum distance landing roll requires moderate brake pedal pressure, without skidding tires, as soon as aircraft weight is firmly on the main wheels. Brake pressure must then be increased as the aircraft decelerates because aircraft weight on the tires increases as wing lift decreases, assisting braking effort.

NEW The wing lift spoilers, when extended with full flaps, reduces wing lift by almost 84 percent and minimizes aircraft weight change on the tires as the aircraft decelerates. Therefore, brakes may be applied as soon as the spoilers are extended, with a moderately heavy pressure that will be slightly increased as the aircraft speed decreases.

NOTE

The maximum braking technique will not be used for normal field landings where adequate runway exists for the aircraft to decelerate below 80 KIAS before applying brakes.

LANDING

The flight shall normally approach the breakup point in echelon, parade formation, at 250 to 300 KIAS. A 3- to 5-second break will provide an adequate downwind interval. Immediately after the break, extend speedbrakes and retard throttle to 70 percent. Speedbrakes will normally remain extended throughout approach and landing. (Speedbrakes increase the stalling speed approximately 1 knot.)

As the aircraft decelerates to 225 KIAS or less, lower the landing gear and extend full flaps. As the airspeed decreases to 170 KIAS, adjust power to maintain desired pattern airspeed commensurate with gross weight. Complete the landing checklist (figure 3-4) and check wheel brakes prior to reaching the 180-degree position. Cross-check airspeed with AOA indexer indication. At a gross weight of 14,000 pounds, recommended approach speed is approximately 125 KIAS at the abeam position (figure 3-6). Optimum AOA indication is 17 1/2 units.

NOTE

For each 1000-pound increase over 14,000 pounds, optimum approach speed (determined by the AOA indexer) increases approximately 5 KIAS.

If a discrepancy between indexer and airspeed exists, recheck landing configuration and gross weight and approach at recommended airspeed. Report error in AOA calibration.

Begin the turn into the base leg at a point slightly downwind of the landing end of the runway in order to have adequate straightaway for corrections on final. Optimum angle-of-attack approaches to touchdown will be made. Where a mirror is available, its use is recommended. Attempt to control meatball, lineup, and angle-of-attack/airspeed as precisely as for a carrier approach in order to maintain proficiency in this technique.

Upon touchdown, the following technique is recommended:

1. Power to IDLE
2. Flaps as required by landing conditions.
3. After touchdown apply full forward stick deflected into the wind as necessary to maintain a wings level attitude. Apply rudder as required to maintain directional control.
4. Use brakes as necessary.
5. As rudder becomes ineffective, use brakes for directional control.
6. Below 60 KIAS, nosewheel steering may be used for directional control. (All A-4F.)

Prior to turning off the runway, aircraft speed must be slowed to about walking speed. ON A GO-AROUND, WAVEOFF, OR TOUCH-AND-GO, DO NOT RAISE LANDING GEAR UNLESS LEAVING PATTERN.

NOTE

REFER TO LANDING DISTANCE CHARTS IN SECTION XI FOR FINAL APPROACH AND TOUCHDOWN SPEEDS.

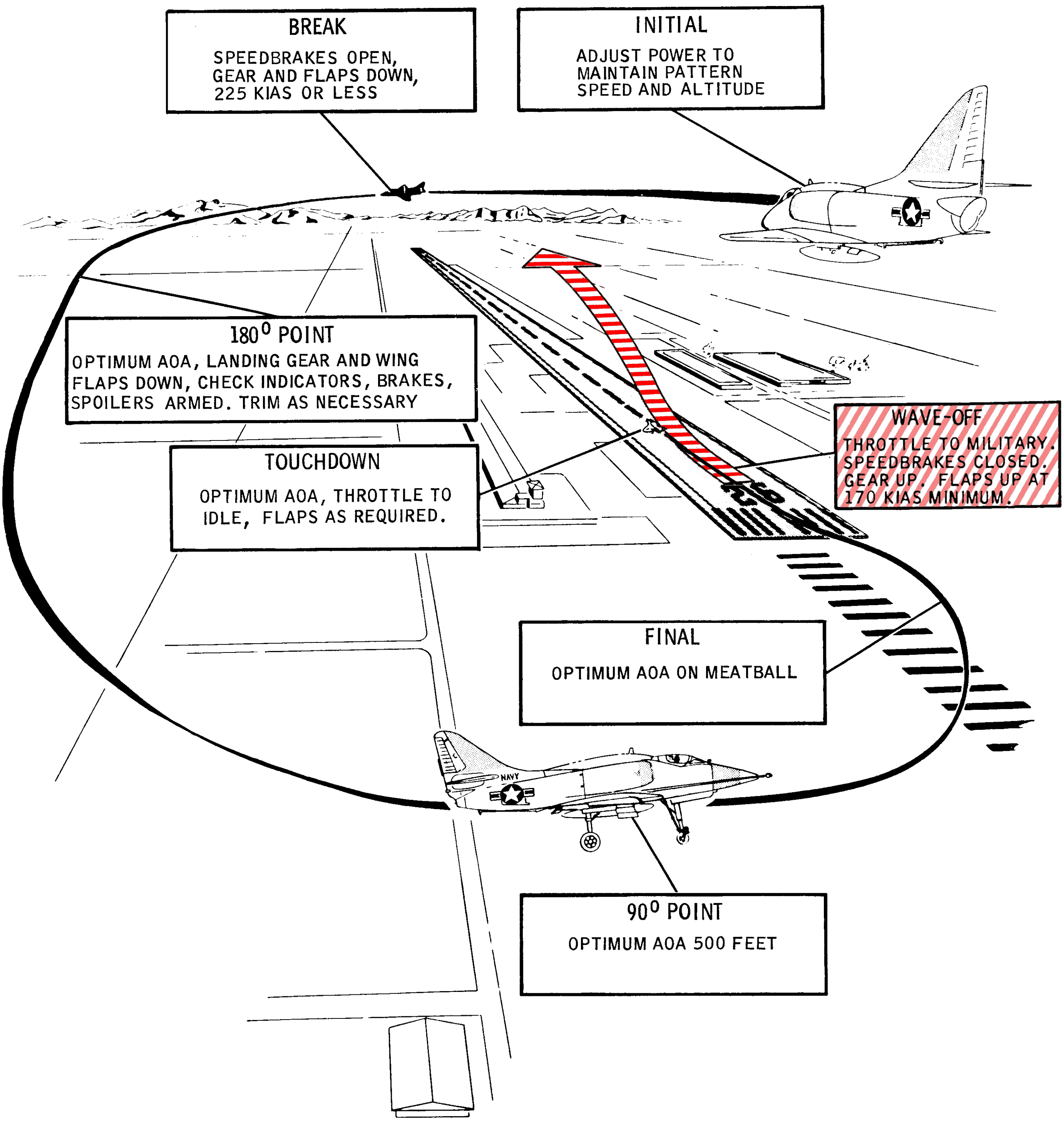


Figure 3-6. Landing and Waveoff Patterns

Crosswind Landing

Crosswind landings are not recommended with a 90-degree crosswind component in excess of 25 knots. During the approach, maintain wing down into the wind and opposite rudder, as required, to maintain lineup. At touchdown, the aircraft alignment should be straight down the runway with no drift. After touchdown, under mazimum crosswind components or less, the aircraft can easily be controlled directionally by applying aileron into the wind and using wheel brakes as required. If the upwind wing is allowed to rise, the nose of the aircraft will tend to track toward the downwind side rather than "weather-cocking" into the wind as is normally expected. If strong crosswinds exist, land on the upwind side of the runway. The following procedure is recommended immediately after touchdown.

1. Reduce power to IDLE.

2. Maintain stick deflection into the wind as required and allow nose of aircraft to fall through. When nosewheel is on deck, apply full forward stick deflected into the wind as required to maintain a wings level attitude.

3. Raise the flaps to further reduce wing lift.

4. Extend speedbrakes to shorten landing roll if not already extended.

5. Use wheel brakes as necessary, but do not skid the tires.

6. Below 60 KIAS, nosewheel steering may be used for all directional control. (All A-4F.)

NOTE

Effectivity: All A-4F aircraft.

Ensure that rudder is centered prior to engagement of nosewheel steering.

During a crosswind landing with the power boost disconnected, increased control stick pressures and reduced control sensitivity make the landing extremely hazardous. If the crosswind component exceeds 8 knots, it is recommended that the field arresting gear be used.

CAUTION

- Maximum recommended crosswind component is 15 knots at 90 degrees when spoilers are unavailable (loss of utility hydraulic pressure, on emergency generator power, etc.)
- At high values of 90 degrees crosswind component (20 to 25 knots), wind gusts become more prevalent and close attention must be paid to lateral control, particularly when landing with asymmetric store loadings.

NOTE

With any asymmetrical load, the maximum permissible crosswind component under the loaded, or heavy wing, is 15 knots without spoilers and 25 knots with spoilers open.

Minimum Distance

To accomplish a minimum distance landing, the following procedure is recommended:

1. Maintain optimum angle-of-attack during approach.

2. Upon touchdown, let the nose fall through and use full forward stick.

3. Leave the flaps fully extended unless there is excessive crosswind.

4. Apply moderately heavy braking immediately after the nosewheel is on the runway.

5. Maintain steady braking throughout the rollout to a stop or desired taxi speed, increasing brake pedal pressure as the speed decreases.

6. Landing roll.

   a. If circumstances dictate, the landing roll may be further reduced by shutting down the engine upon touchdown. (All A-4E.)

   b. If circumstances dictate, the landing roll may be further reduced by shutting down the engine at 80 KIAS. (All A-4F.)

NOTE

Spoilers will close after engine shutdown.

Securing Engine

The following steps will be performed prior to shutdown:

1. Flaps . . . . UP
2. Speedbrakes . . . . IN
3. Spoilers . . . . CLOSED
4. Horizontal stabilizer trim. . . . . ZERO DEGREES
5. Drop tank switch . . . . OFF
6. Radios and all electrical equipment. . . . . OFF
7. Gear pins, ordnance pins and chocks . . . . IN PLACE
8. Ejection control safety handle. . . . . DOWN
9. Check oil level by depressing OIL LOW indicator/switch (if installed). If light comes on, oil level is below 80 percent and must be serviced.

NOTE

Except for an emergency or operational necessity, when engine has been operated at or above 85 percent rpm for periods exceeding 1 minute, within 6 minutes prior to shutdown; the engine should be operated at IDLE for 30 seconds prior to shutdown to prevent overheating the rear bearings.

10. INT/EXT power switch . . . EXT (Plane captain)

NOTE

In aircraft equipped with underfrequency protector (A-4 AFC 338), step 10 need not be performed.

11. With engine stabilized at IDLE, throttle . . . . OFF
12. Time engine rundown. Be alert for unusual compressor noises.
13. Oxygen . . . . OFF

FIELD CARRIER LANDING PRACTICE (FCLP)

Pattern-Entry Procedure

INDIVIDUAL ENTRY

Call the tower for entry to the FCLP pattern. Request 800-foot break altitude. Otherwise, follow the normal field entry procedures into the break. When cleared to break and the proper interval of the aircraft downwind is assured, roll into a 45-degree banked turn.

Reduce power to 70 percent and extend speedbrakes. Speedbrakes will normally remain out throughout the approach and landing. Use of speedbrakes may not be desirable at high gross weights (in excess of 13,000 pounds) when configured with high drag stores, i.e., buddy store, MBR's, etc, due to the high thrust required during the approach. At 225 KIAS, lower gear and full flaps. Adjust angle of bank to provide correct distance abeam (1 1/4 miles). Descend to 600 feet AGL on the downwind leg. Pilots shall crosscheck airspeed against angle-of-attack indexer to ensure calibration of indexer prior to turning from the 180-degree position.

FORMATION ENTRY

The leader of the formation will enter the break as described above for single-aircraft entry. When cleared to break, the leader will give the breakup signal and execute a break by rolling into a 45-degree banked turn. The remaining aircraft in the formation will take a 10-second break interval.

Pattern

DOWNWIND

Maintain 600 feet AGL at a comfortable airspeed, but no faster than 150 KIAS. Complete landing checklist.

180-DEGREE POSITION

Altitude should be 600 feet AGL. Plan to lose sufficient airspeed on the downwind leg to arrive at the 180-degree position at the optimum angle-of-attack or approach speed. The approach airspeed will vary with aircraft gross weight. Distance abeam will vary with wind conditions, but 1 1/4 miles abeam

is a normal position. The turn from the 180-degree position will be delayed so as to intercept the glide-slope, wings level at 600 feet AGL.

90-DEGREE POSITION

Altitude should be 600 feet AGL with the aircraft at optimum angle-of-attack/airspeed.

FINAL

When the "meatball" appears in the center of the mirror, it will be necessary to reduce power slightly and ease the nose over, maintaining optimum angle-of-attack/airspeed. Proper glide slope and approach speed are maintained by keeping the "meatball" centered by coordinated adjustments of power for altitude corrections, and of attitude for airspeed corrections. The straightaway, with winds level, should be about 1-1/2 miles long.

Once the "meatball" is sighted, the approach should be monitored by cross-checking MEATBALL, LINEUP, ANGLE-OF-ATTACK INDEXER/AIRSPEED. Make necessary corrections immediately but smoothly.

LANDING

Keep the aircraft on the glide slope and centerline. Keep the "meatball" centered until touchdown. Do not flare. Upon touchdown, add full power and retract speedbrakes immediately. Climb straight ahead until reaching at least 300 feet and 150 KIAS. Turn downwind when the aircraft ahead is approximately in the 10 o'clock position on the downwind leg. Do not exceed 150 KIAS in the pattern. About 30-degree angle of bank turning downwind should establish the correct distance abeam. Extend speedbrakes on the downwind leg prior to reaching the 180 degree position.

WAVEOFF

To execute a waveoff, immediately add full power, retract speedbrakes, and transition to a climbing attitude to prevent further loss of altitude. Make all waveoffs directly down the runway until at least 300 feet of altitude and 150 KIAS are attained.

NIGHT FLYING

Flight Procedures

See section IV.

Night Lighting Doctrine Shore-Based Operations

LINE AREA

CAUTION

With external lights on BRT, application of external power or starting the aircraft may cause failure of the lights. Allow 60 seconds for warmup after electrical power is applied to aircraft.

Prior to start, turn wing and tail lights to STDY/DIM and all others to OFF. This is the minimum lighting condition that should be used whenever the engine is running. Turn the master exterior lights switch ON, so that when the engine starts the exterior lights will come on. Perform customary poststart checks, including exterior lights check. Signal the plane captain when ready to taxi by flashing the exterior lights. Taxi in the line area with fuselage and anticollision lights OFF and remaining navigational lights DIM.

TAXIING

Once clear of the line area, turn lights to BRT/FLSH.

The taxilight should be utilized whenever the field lighting is insufficient for safe ground operations. Discretion is required, since night vision may be impaired.

WARNING

Utilization of the taxilight while airborne may destroy night vision and cause disorientation.

AT APPROACH END OF RUNWAY

While completing the takeoff checklist in the turnup area, keep all lights BRT/FLSH unless other aircraft are in the turnup area, in which case it may be necessary to dim all lights to prevent pilots of other aircraft from losing their night vision.

It may be necessary to modify the above procedure to conform to local operating procedures.

TAKEOFF

For single-aircraft takeoff, all lights will normally be BRT/STDY with anticollision light on, unless otherwise specified in local operating regulations. For a section takeoff, the leader will turn his lights DIM/STDY when in position on the runway, while the wingman will have his lights on BRT/STDY. After turnup to 90 percent, the wingman will indicate his readiness to go by turning on his anticollision light. The leader will signal "Brake release and adding power," by blinking his exterior lights.

OPERATING CLEAR OF TRAFFIC PATTERN

For single-aircraft flights, once clear of the pattern, lights will be BRT/STDY with anticollision lights on.

When joining in formation, the following procedures will be utilized: As each pilot calls "ABOARD" (when he is in such a position that dimming the lights of the aircraft ahead will not affect his rendezvous), the pilot ahead will turn his fuselage and anticollision lights OFF and other lights DIM/STDY (fuselage light intensity as briefed or as desired by wingman). Normal lighting for aircraft in formation other than the last aircraft will be wing and tail DIM and all other lights OFF. As each aircraft breaks for rendezvous practice, the pilot will turn all lights to BRT/STDY and anticollision light on.

For night section penetrations, the leader will have his fuselage and anticollision lights OFF and remaining lights on DIM/STDY. The wingman will leave all lights BRT/STDY and anticollision light on, if a VFR letdown is to be made. However, at any time that instrument conditions will be encountered the wingman will turn all lights to BRT/STDY and anticollision lights OFF prior to entry into the clouds.

LANDING PATTERN

When returning to the base for normal breakup and landing, the lights will be at DIM/STDY, except the last aircraft will be at BRT/STDY with anticollision light on. The break will be signaled by each pilot blinking the exterior lights, just before break. Normally a 5- to 7-second interval will be used. All lights will be turned to BRT/STDY and anticollision on, when well clear of the formation. Lights remain on BRT/STDY and anticollision on, for as long as aircraft remain in traffic pattern or unless otherwise directed by the tower or LSO. Single aircraft entering the break will have lights on BRT/STDY and anticollision lights on.

When in the line area, after landing, turn fuselage anticollision lights to OFF and other lights to DIM/STDY.

FUNCTIONAL CHECK FLIGHT PROCEDURES

Check Pilots

The most important single factor in obtaining good check flights on the aircraft is to select experienced, conscientious check pilots. Commanding officers will designate, in writing, those pilots within their command who are currently eligible to perform this duty.

Check Flights and Forms

Check flights will be performed when directed by, and in accordance with, the directions of NAVAIRSYSCOM, Type Commanders, or other appropriate authority. Functional flight check requirements and applicable minimums are described below. Functional check flight checklists are promulgated separately.

FUNCTIONAL CHECK FLIGHT REQUIREMENTS

The functional check flight will be performed after the completion of the calendar maintenance requirements using the applicable Functional Check Flight Checklist. A detailed description of the check flight rerequirements, sequenced in the order to be performed appears in the following paragraphs. The check flight personnel will familiarize themselves with these requirements prior to the flight. NATOPS procedures will apply during the entire check flight. A daily inspection is required prior to the check flight.

CONDITIONS REQUIRING FUNCTIONAL CHECK FLIGHTS

Check flights are required under the following conditions (after the necessary ground check and prior to release of the aircraft for operational use):

1. At the completion of a Calendar Inspection. (Minimum: entire check, paragraphs I through V).

2. At the completion of aircraft rework. (Minimum: entire check, paragraphs I through V.)

3. After the installation of engine. (Minimum: all engine and fuel control checks, paragraph I, B and C; paragraph II, A, B, C, E 1, H 1, J (2b(1)); paragraph V, A (1-4).)

4. After the installation of any major components of the fuel system. (Minimum: all fuel control and fuel system checks, paragraph I, B and C; paragraph II, A, B, C, E 1, E 23, H 1, J (2b (1)) J 5,; paragraph V, A (1-4).

5. When fixed flight surfaces have been installed. (Minimum: Disconnect/rate-of-roll check, paragraph III).

6. When movable flight control surfaces have been replaced, removed for major repairs or rigged. (Minimum: Disconnect/rate-of-roll check, paragraph III.)

7. When primary control cables, rods, or tubes have been replaced or rigged. (Minimum: Disconnect/rate-of-roll check, paragraph III.)

8. When control system components have been adjusted or replaced, and where improper adjustment or installation of such components could adversely affect flight characteristics or result in loss of control of the aircraft. (Minimum: Disconnect/rate-of-roll check, paragraph III.)

9. After accomplishment of any modifications or repairs affecting any of the foregoing.

10. The requirement for a check flight, under circumstances other than those specified above, is a determination to be made by the Maintenance Officer and will be based on the scope of the work accomplished and its effect on safety or reliability of operation.

NOTE

Local commands shall set minimums for check requirements for items 9 and 10 using the minimum as set forth in items 1 through 8 as a guideline.

CHECK FLIGHT PROCEDURES

NOTE

For preflight, starting and pretaxi procedures refer to appropriate checklists contained in previous paragraphs of this section.

I. Pretakeoff

A. TAXI CHECKS

1. Brakes . . . . CHECK

a. Check pressure prior to pulling chocks. Brakes should hold aircraft at 90% rpm (note binding, mushing, drag or pulling).

b. Spongy chattering or fading brakes unacceptable.

c. Taxi and takeoff check for presence of yaw and if affected by brakes.

2. Nosewheel Steering (A-4F). . . . . CHECK

CAUTION

Maximum speed for operation of nosewheel steering system is 60 KIAS. Due to high residual engine thrust at IDLE, excessive taxi speeds may result while taxiing with nosewheel steering. Avoid making sharp turns under this condition to preclude loss of control and possible ground looping of aircraft.

a. Engage (Steering switch in normal position and stick control button depressed).

(1) Transients . . . . DIRECTIONAL TRANSIENTS FROM NORMAL TRACKING DURING TAXI, LANDING OR TAKE-OFF ROLL NOT ACCEPTABLE.

(2) Pedal deflection . . . . VERIFY THAT AIRCRAFT TRACKS IN DIRECTION OF APPLIED RUDDER.

(3) Nosewheel deflection . . . . WITH NOSEWHEEL STEERING DISENGAGED AND PEDALS NEUTRAL, NOSEWHEEL SHOULD RETURN TO CENTER. (STATIC CHECK)

NOTE

- On aircraft reworked per A-4 AFC 421 (Int), nose gear hydraulic centering and lock does not function with the hook down.
- On aircraft reworked per A-4 AFC 429, the nosewheel is hydraulically centered and locked with the hook down. Steering is available by actuating the nosewheel steering button.

b. Disengage (Stick control button released).

(1) Castering . . . . AIRCRAFT SHOULD TRACK SMOOTHLY IN DIRECTION OF APPLIED BRAKING.

c. Emergency Off

(1) Emergency off position . . . . NOSEWHEEL STEERING SHOULD DISENGAGE WHEN STEERING IS PLACED IN EMER OFF POSITION.

3. Rate-of-Turn Operation . . . . CHECK

a. Note needle indicating proper turn. Note hang up or excessive oscillation.

4. Wing Spoilers (Effectivity: All A-4E reworked per AFC 442 and A-4F) . . . . CHECK

a. Normal operation (ARM position). . . . . ACTUATION SHOULD OCCUR WITH LANDING GEAR STRUTS COMPRESSED AND THROTTLE POSITION BELOW APPROXIMATELY THE 70% POSITION.

5. Heading Indicators . . . . CHECK

a. Note proper turn indication of AJB-3/3A, BDHI, RMI and standby magnetic compass. Note any sticking, jitter or hang up.

6. Oxygen Quantity . . . . RECORD

7. Altimeter . . . . RECORD

a. Obtain current setting. RECORD and set. Maximum allowable error at Sea Level is 75 feet (refer to allowable error chart if not at sea level).

B. PRETAKEOFF CHECKLIST

1. Takeoff Checklist

a. Perform takeoff checklist requirements.

2. Manual Fuel Control Checks. Switch to manual fuel control at 65 percent rpm.

a. Compressor stall unacceptable. Manual fuel control light comes ON.

b. EGT maximum

(J52-P-6A) 650°C . . . . RECORD

(J52-P-6B) 660°C . . . . RECORD

(J52-P-8A/B) 680°C . . . . RECORD

c. Fuel flow

(J52-P-6A/B) . . . . Approximately 5300 to 6200 pph . . . . RECORD

(J52-P-8A/B) . . . . Approximately 5200 to 6800 pph . . . . RECORD

d. EPR minimum

(J52-P-6A/B) . . . . 2.0 . . . . RECORD

(J52-P-8A/B) . . . . 2.3 . . . . RECORD

e. Fuel changeover MANUAL to PRIMARY – Changeover from MANUAL to PRIMARY should be done at 80 to 85 percent rpm and manual fuel control warning light should go off. If compressor stall occurs, return to MANUAL and position throttle to 78 percent rpm. Return throttle to IDLE and while engine is decelerating, attempt another changeover. Occurrence of compressor stall is unacceptable.

f. Oil pressure (military rpm) 40 to 50 psi . . . . RECORD

C. TAKEOFF

1. Takeoff Engine Acceleration Limits (Military Power).

a. Acceleration time . . . . 13 seconds maximum . . . . . . RECORD

b. RPM

(J52-P-6A/B) . . . . 102.6 percent maximum . . . . . . RECORD

(J52-P-8A/B) . . . . 102.9 percent maximum . . . . . . RECORD

c. EGT

(J52-P-6A) . . . . . . 650°C maximum for 8 minutes . . . . . . RECORD

610°C maximum stabilized . . . . . . RECORD

(J52-P-6A/B) . . . . 660°C maximum for 8 minutes . . . . . . RECORD
621°C maximum stabilized . . . . . . RECORD

(J52-P-8A/B) . . . . 680°C maximum for 8 minutes . . . . . . RECORD
650°C maximum stabilized . . . . . . RECORD

d. Pressure ratio should be at or above indicator bug setting for ambient temperature at pretakeoff check.

e. Oil pressure. . . 40 to 50 psi . . . . . RECORD

II. Inflight

A. CLIMBING THROUGH 16,000 FEET

1. Climb to altitude (approaching 16,000 feet) military power; check bias as follows:

a. RPM . . . . Takeoff rpm (+1/2, -1 1/2 percent) . . . . RECORD

b. EGT

(J52-P-6A) . . . . . . 610°C maximum stabilized . . . . . . RECORD

(J52-P-6B) . . . . . . 621°C maximum stabilized . . . . . . RECORD

(J52-P-8A/B) . . . . 650°C maximum stabilized . . . . . . RECORD

c. Oil pressure. . . 40 to 50 psi . . . . . RECORD

NOTE

If bias rpm falls outside above limits, RECORD altitude, EGT, and rpm for comparison with data corrected to ambient conditions.

B. CLIMBING THROUGH 26,000 FEET

1. Climb to altitude (approaching 26,000 feet) military power; check bias as follows:

a. RPM . . . . Takeoff rpm (+1/2, -1 1/2 percent) . . . . RECORD

b. EGT

(J52-P-6A) . . . . . . 610°C maximum stabilized . . . . . . RECORD

(J52-P-6B) . . . . . . 621°C maximum stabilized . . . . . . RECORD

(J52-P-8A/B) . . . . 650°C maximum stabilized . . . . . . RECORD

c. Oil pressure. . . 40 to 50 psi . . . . . RECORD

2. Pressurization

a. 16,000 feet. . . . 8000 (±1000 feet) . . . . . RECORD

b. 26,000 feet. . . . 14,000 (+1300, -1800 feet) . . . . . RECORD

C. LEVEL AT 36,000 FEET

1. Jam Acceleration Check (180 KIAS minimum)

a. RPM . . . . (IDLE) . . . . RECORD

b. EGT . . . . (IDLE) . . . . RECORD

c. Fuel flow . . . . . (IDLE) . . . . RECORD

d. Pressurization . . . . (IDLE) 20,000 +1600, -2600 feet . . . . . RECORD

e. Time idle to military . . . . 20 seconds maximum . . . . . . RECORD

f. RPM (military) . . . . Takeoff rpm (+0, -3 1/2 percent) . . . . RECORD

g. EGT (military)

(J52-P-6A) . . . . . . 650°C maximum for 8 minutes . . . . . . RECORD
610°C maximum stabilized . . . . . . RECORD

(J52-P-6B) . . . . . . 660°C maximum for 8 minutes . . . . . . RECORD
621°C maximum stabilized . . . . . . RECORD

(J52-P-8A/B) . . . . 680°C maximum for 8 minutes . . . . . . RECORD
650°C maximum stabilized . . . . . . RECORD

h. Fuel flow (military) . . . . RECORD

i. Oil pressure . . . 40 to 50 psi . . . . . RECORD

D. DESCENDING TO 20,000 FEET

CAUTION

- Do not exceed 0.90 indicated Mach number (IMN) with external tanks installed.
- Noseover from suitable altitude to obtain 0.90 (tanks installed) to 1.05 IMN (tanks not installed), and check controls. No limit specified.

1. Speedbrakes . . . . CHECK

Level flight 20,000 feet; 1.0g flight at 400 KIAS.

a. Open . . . . 3 SECONDS MAXIMUM

b. Closed . . . . 3 SECONDS MAXIMUM

c. Pitch . . . . +1.0 MAXIMUM AND -0.5G MAXIMUM

d. Yaw . . . . ±1/2 BALL (BALL MUST RETURN TO CENTER TO INDICATE AN IN-TRIM CONDITION)

e. Roll . . . . 5 DEGREES PER SECOND MAXIMUM

E. LEVEL AT 20,000 FEET

1. Pressure Ratio Indicator . . . . CHECK

a. Index and counter should move smoothly when setting knob is rotated.

2. Fuel Quantity Indicator . . . . CHECK

a. Indicated total fuel available in pounds multiplied by 1000.

b. Range of indication is from 0 to 6400 pounds.

c. The fuel quantity indicator gage can be tested by the press-to-test button on the instrument panel.

3. Liquid Oxygen Quantity Indicator . . . . CHECK

a. Indicates liquid oxygen available from 0 to 10 liters.

b. Has a small OFF window to show indicator is inaccurate when electrical power is lost.

c. A red low-level warning light comes on when oxygen quantity falls below 1 liter.

d. The liquid oxygen quantity indicator can be tested by a press-to-test button on the instrument.

4. Vertical Velocity Indicator . . . . CHECK

a. Ground check, needle should indicate 0±100 feet per minute.

b. Indicator error within 300 feet per minute of altimeter at a rate of 2000 feet per minute

5. Altimeter (Aircraft) . . . . CHECK

a. Prior to start, allowable scale error at field elevation:

Allowable scale error . . .	0 TO 500±50 FEET
	1,000±75 FEET
	5,000±150 FEET
	10,000±175 FEET
	12,000±200 FEET

b. Allowable needle jump with established 3000-feet per minute climb. A 100-foot jump is acceptable when needle is passing between 9 and 0.

6. Altimeter (Cabin) . . . . CHECK

a. Prior to start, field elevation plus scale error after barometric compensation:

Scale error	0M±200 FEET
	5M±300 FEET
	10M±400 FEET

7. Airspeed and Mach . . . . CHECK

a. Indication at 16,000 feet with 405±12 KIAS (IMN 0.80).

b. Indication 36,000 feet with 275±7 KIAS (IMN 0.83).

c. MACH operation should be smooth, indices movable.

8. Accelerometer . . . . CHECK

Normal reading . . . . 1±0.2G

9. ID-811 Rate-of-Turn . . . . CHECK

Rate-of-turn 120±15 seconds for 180-degree standard rate-of-turn at 250 KIAS (1/2-needle width).

10. AJB-3A All-Attitude Indicating System (AAI)

(Preflight)

a. Vertical Gyro (Gyro Erection) . . . . . CHECK

(1) Off flag drops within 98 seconds maximum.

(2) Roll attitude ±2 degrees aircraft attitude in 3 minutes.

(3) Pitch attitude ±2 degrees aircraft attitude in 3 minutes.

b. Indicator Display (Attitude) . . . . CHECK

(1) Pitch trim knob rotation (cw for dive, ccw for climb) 10-degree minimum dive. Minimum climb 5 degrees (from 0 to dot).

c. Directional Gyro (Gyro Erection) . . . CHECK

(1) Off flag drops within 98 seconds maximum.

(2) Automatic synchronization 12±3 seconds after flag drops.

(3) Synchronization needle accuracy within 3/4 scale.

(4) Slow slave 1.5±0.5 degrees per minute.

(5) Synchronization needle accuracy after 3 minutes within 1/4 scale of zero. (May oscillate about this point.)

d. Indicator Display (Heading Accuracy) . . . . CHECK

(1) AAI within 3.5 degrees of ID-663 BDHI indication.

(2) BDHI within ±3.0 degrees of true magnetic heading.

e. Slew Knob Operation (Push to Turn) . . . . CHECK

(1) On cw, synchronization needle displaces to the right. AAI and BDHI increase heading.

(2) On ccw, synchronization needle displaces to the left. AAI and BDHI decreases heading.

(Inflight)

f. Vertical Gyro . . . . CHECK

(1) Precession after takeoff turns ±4.0 degrees in roll.

(2) Precession after 180-degree 4-minute turn ±3.0 degrees in roll or pitch.

(3) Gyro erection (slow erection rate 0.8 to 1.8 degrees per minute) to within ±2.0 degrees in roll or pitch.

(4) Indicator jitter and/or hangup ±0.5 degree.

g. Directional Gyro . . . . CHECK

(1) Accuracy (4 headings, 90 degrees apart) within ±4.0 degrees maximum of true magnetic heading of aircraft.

(2) Synchronization needle oscillations allowed about midposition.

(3) Precession in 360-degree 4-minute turn ±2.0 degree change in heading error.

11. Standby Attitude System

(Preflight)

a. Gyro Erection . . . . CHECK

(1) Off flag drops within 75 seconds maximum.

(2) Roll attitude ±2 degrees of aircraft attitude within 3 minutes.

(3) Pitch attitude ±2 degrees of aircraft attitude within 3 minutes.

b. Indicator Display. . . . . CHECK

(1) Pitch trim knob rotation (cw for dive, ccw for climb) 10 to 20 degrees dive, 5 to 10 degrees climb (from 0 dot).

(Inflight)

c. Vertical Gyro. . . . . CHECK

(1) Precession after takeoff turns, ±4 degree roll.

(2) Precession after 180 degree, 4-minute turn (from indication at start of turn, ±3 degrees in pitch or roll).

(3) Erection time:

Normal 1.5 to 2.5 degrees per minute.

Manual (do not hold erection switch over 60 seconds maximum) not less than 0.5 degree per second.

d. Indicator . . . . CHECK

(1) Jitter and/or hangup ±1 degree maximum.

(2) Attitudes over 82 degrees in pitch will result in 180-degree roll indication.

(3) Difference between AAI and standby ±3 degrees maximum.

NOTE

Check should be made upon returning to same airspeed and attitude as original setting.

12. Gunsight. . . . . CHECK

a. Ladder-type, lighted reticle controlled by rheostat containing primary and alternate filaments located on upper left-hand corner of instrument panel.

b. Sight elevation controlled by sight elevation knob located on left-hand side of gunsight.

13. ID-663 Bearing Distance Heading Indicator (BDHI). . . . . CHECK

a. Displays magnetic heading and distance and relative bearings, in relation to a ground or shipboard station.

b. An off-flag is displayed when distance information is not present (TACAN).

c. The No. 1 needle (a single-bar pointer) displays ARA-50/25 operation and the No. 2 needle (a double-bar pointer) displays OMNI or TACAN information.

14. Standby Compass . . . . CHECK

a. Heading error ±3.0 degrees of BDHI after magnetic variation compensation.

15. UHF Radio ARC-27 or ARC-51A . . . . CHECK

a. System must transmit and receive ground station on minimum of five channels and guard frequencies.

b. Squelch should be silent when disabling switch is off.

c. SENS should be silent when SENS dial is fully ccw.

d. Volume, variable control from radio control panel.

e. Operational range is 100 nautical miles minimum.

f. Operational performance is line-of-sight.

16. ARR-69 UHF Auxiliary Radio Receiver . . . . CHECK

a. System must receive ground station on minimum of five channels and guard frequencies.

b. SENS should be silent when SENS dial is low.

c. Volume, variable control from radio control panel.

d. Operational range is 100 nautical miles minimum.

e. Operational performance is line-of-sight.

17. UHF-ADF ARA-25 or ARA-50 . . . . CHECK

a. Operating range is line-of-sight.

b. Heading error ±5.0 degrees off nose sector and 20 degrees in all other sectors.

c. Hunting errors ±1.0 degree.

18. Identification Radar Beacon APX-6 or APX-64 . . . . CHECK

a. Check identification modes with available interrogating station.

b. Operating range is line-of-sight.

19. ARN-52 TACAN (Antenna in AUTO position). . . . . CHECK

a. Operating range is 300 nautical miles.

b. Operating performance is line-of-sight.

c. Range indication in operation is no flag showing.

d. Adjust volume control for proper tone level of identification signal.

e. Bearing accuracy ±1 degree at the following relative bearings: 0, 90, 180, 270 degrees.

f. Bearing tracking rate 20 degrees per second bidirectional.

g. Auto antenna lockon 9 seconds maximum with usable signal.

h. Air-to-air mode, range lock-on with cooperating aircraft or station.

20. Bombing System Tests

a. Loft Bombing Test (Through LABS Timer) . . . . CHECK

(1) Timer (ser for 1.0 second). . . . . . . 1.0-SECOND WARNING TONE AND LIGHT

(2) Time out . . . . PULLUP TONE AND LIGHT

b. G-Programmer (Horizontal Pointer, AJB-3A) . . . . CHECK

(1) Pickle . . . . LABS LIGHT ON. VERTICAL POINTER CENTERS. PROGRAMMER DEFLECTS TO CENTER.

(2) Pullup . . . . RUNDOWN TO 4G IN 2.0 SECONDS.

c. All-Attitude Indicator (Pullup Time) . . . . CHECK

(1) Pitch. . . . . PITCH TRIM REMOVED

(2) Azimuth. . . . . LOCKS ON AAI

(3) Roll. . . . . DISPLAYS ROLL/ YAW

(4) Vertical pointer (AJB-3A) . . . . DISPLAYS ROLL/ YAW

Angle of bank (AJB-3) . . . . DISPLAYS ROLL/ YAW

(5) Yaw/Roll ratio . . . . 2.5 to 3.5:1

(6) Yaw cancel . . . . 20±10 DEGREES YAW

(7) Low-angle release . . . . 50-DEGREES PITCH

High-angle release . . . . 120-DEGREES PITCH

(8) At release and/ or cancel . . . . REVERT TO ALL-ATTITUDE INDICATION.

(9) Additional verticality error upon completion . . . . ±1.0-DEGREE ROLL ±2.0-DEGREE PITCH

(10) Additional heading error upon completion . . . . ±2.0-DEGREE AZIMUTH

d. Instantaneous Over-the-Shoulder Bombing Test (G-Programmer Horizontal Pointer, AJB-3A) . . . . CHECK

(1) Pickle . . . . LABS LIGHT ON – RUNS DOWN TO 4G IN 2 SECONDS.

e. All-Attitude Indicator . . . . CHECK

(1) Tracking at 90-degree position . . . . . FOLLOWS AIRCRAFT MOTION

(2) High-angle release. . . 120-DEGREE PITCH

21. ASN-41 Navigational Computer Set

a. Position . . . . CHECK

(1) Wind speed . . . . 223.6±1.5 KNOTS

(2) Wind direction. . . . . . 90.5±1.5 DEGREES

(3) Present position counters integrate south and east.

b. Bearing error . . . . 2.0 degrees maximum . . . . CHECK

c. Range error . . . . CHECK

(1) 0 to 195 miles . . . . . . 1 MILE OR 1 PERCENT DISTANCE TRAVELED

(2) 195 to 2000 miles. . . . 5 MILES PLUS 1 PERCENT DISTANCE TRAVELED

NOTE

Tolerances for subitems b and c are for zero wind conditions.

22. APN-153 Doppler Radar Navigation Set

a. Test position (readings after 5 minutes). . . . . CHECK

(1) Memory light . . . . . . EXTINGUISHED

(2) Groundspeed . . . . 121±5.0 KNOTS

(3) Drift angle . . . . 0 ±2.0 DEGREES

b. Level flight. . . . . CHECK

(1) Takeoff . . . . WITHIN 30 SECONDS AFTER MINIMUM ALTITUDE OF 40 FEET AND MINIMUM AIRSPEED OF 80 KNOTS, MEMORY LIGHT SHOULD GO OFF INDICATING SYSTEM TRACKING

c. Cruise altitude . . . . CHECK

(1) ON-LAND position . . OBSERVE GROUNDSPEED AND DRIFT ANGLE TO BE CORRECTED WITHIN ±50 KNOTS AND ±10 DEGREES RESPECTIVELY FOR KNOWN CONDITIONS OF FLIGHT.

(2) ON-SEA position . . . OBSERVE SLIGHT INCREASE IN GROUNDSPEED INDICATION FROM ON-LAND POSITION.

(3) Memory light . . . . . SHOULD NOT BE ON FOR PERIODS LONGER THAN 30 SECONDS.

d. Maneuvers . . . . CHECK

(1) Banked turns. . . . . . GROUNDSPEED AND DRIFT ANGLES SHALL TRACK IN BANK ANGLES OF APPROXIMATELY 30 DEGREES.

(2) Climbing and descending . . . . GROUNDSPEED AND DRIFT ANGLES UP TO 25-DEGREES ATTITUDE. MEMORY LIGHT SHOULD NOT BE ON FOR PERIODS LONGER THAN 30 SECONDS.

e. Doppler Radar Navigation System . . . . CHECK

(1) Wind direction. . . . . DISPLAYED

(2) Wind speed . . . . DISPLAYED

(3) Distance to target

(a) 0 to 195 miles . . 1 MILE OR 1 PERCENT OF DISTANCE.

(b) 195 to 2000 miles . . . . 5 MILES AND 1 PERCENT OF DISTANCE

(4) Bearing error . . . . . ±2.0 DEGREES

23. Drop Tank Transfer . . . . CHECK

a. Drop tank switch to PRESS position . . . . PRESSURIZES DROP TANKS TRANSFERRING FUEL FROM DROP TANKS TO WING TANK OR FUSELAGE TANK.

b. Fuel transfer rate (90 percent rpm power setting)

0 to 5000 feet altitude . . . 8000 PPH

25,000 to 35,000 feet altitude . . . . 4000 PPH

c. Drop tank switch to OFF. . . . . FUEL STOPS TRANSFERRING.

F. TRIM CHECK AT 20,000 FEET

1. At 300 KIAS, trim aircraft for hands-off, straight and level flight (2000 to 4000 pounds fuel load recommended) . . . . CHECK

a. Rudder trim indication. . . . . 0±1.0 DEGREE

2. Aileron Power Configuration . . . . . . CHECK

a. Breakout force . . . . 3.8 POUNDS MAXIMUM

b. Control stick backlash. . . . . 1/8 INCH MAXIMUM

3. Elevator Power Configuration . . . . CHECK

a. Breakout force . . . . 3.8 POUNDS MAXIMUM

b. Control stick backlash. . . . . 3/8 INCH MAXIMUM

4. Rudder System . . . . CHECK

a. Breakout force . . . . . 7 TO 13 POUNDS

b. Control force backlash . . . . 1/4 INCH MAXIMUM

5. Stabilizer . . . . CHECK

Manual stabilizer override switch should override the stick switch in both directions.

6. Standby Compass . . . . CHECK/RECORD

Check standby compass against BDHI headings.

G. SLOW SPEED CHECK AT 20,000 FEET

1. Landing Gear . . . . CHECK

a. Gear up . . . . 14 SECONDS MAXIMUM (210 KIAS)

b. Gear down . . . . 5 TO 11 SECONDS

2. Landing Flaps . . . . CHECK

a. Flaps down. . . . . 10 SECONDS MAXIMUM (160 KNOTS AND UNDER)

b. Flaps up. . . . . 7 SECONDS MAXIMUM (160 KNOTS AND UNDER)

3. Flap Blowback. . . . . CHECK

Indication of flap blowback should occur at approximately 230 KIAS. Two-thirds flap indication at 275±10 KIAS. Maximum permissible speed without flap blowback indication is 240 KIAS.

4. Wing Slats . . . . CHECK

Wing slats should commence opening at approximately 200 KIAS and are fully open at stalling speed.

5. Angle-of-Attack System. . . . . CHECK

a. Indicator needle moves ccw as angle of attack is increased.

b. All angle-of-attack indexer lights come ON when press-to-test button is depressed.

Approach Light Color (HOOK AND GEAR DOWN)	Cockpit Light Display	Indicator Reading
Green	V	18 1/2 to 30 units
Amber	V O	18 to 17 1/2 units
Amber – Optimum Approach	O	17 to 18 units
Amber	O Λ	16 1/2 to 17 units
Red	Λ	0 to 16 1/2 units

c. Retract gear. All approach lights should go off. Retract tailhook. All approach lights should go off.

6. Emergency Generator Operational Limits: (0.90 IMN maximum) . . . . CHECK

a. Initial conditions . . . . AIRCRAFT DIRTY, 150 KIAS, UHF ON UNUSED FREQUENCY, ALL LIGHTS AND AVIONICS EQUIPMENT ON EXCEPT AFCS, RADAR, AND HORIZONTAL TRIM. DROPOUT EMERGENCY GENERATOR.

b. Reduce power to idle keeping UHF keyed. . . . . . NOTE AIRSPEED AT WHICH SIDETONE FADES OUT. AIRSPEED SHOULD BE LESS THAN 120 KIAS.

NOTE

Light should fail and warning flags should appear almost simultaneously with UHF fadeout. Large airspeed spreads between events may indicate marginal systems.

c. Accelerate aircraft, keeping UHF keyed. . . . . . NORMAL SYSTEM OPERATION SHOUL SHOULD BE RESTORED AT NOT MORE THAN 145 KIAS.

d. Operate horizontal stabilizer manual override lever, both noseup and nosedown to ensure trim in both directions.

e. Check bypass switch operation.

H. DESCENT TO 15,000 FEET

1. Jam Acceleration Check (180 KIAS minimum)

a. RPM . . . . . . (idle) . . . . RECORD

b. EGT . . . . . . (idle) . . . . RECORD

c. Fuel flow . . . (idle) . . . . RECORD

d. Pressurization . . . . (idle) 8000±1000 feet . . . . . . CHECK

e. Time idle to military . . . . 20 seconds maximum . . . . RECORD

f. RPM . . . . . . (military) Takeoff rpm (+1/2, -1 1/2 percent) . . . . RECORD

g. EGT (military)

(J52-P-6A) . . . . 650°C maximum for 8 minutes . . . . RECORD

610°C maximum stabilized . . . . RECORD

(J52-P-6B) . . . . 660°C maximum for 8 minutes . . . . RECORD

621°C maximum stabilized . . . . RECORD

(J52-P-8A/B) . . 680°C maximum for 8 minutes . . . . RECORD

650°C maximum stabilized . . . . RECORD

h. Fuel flow (military) . . . . RECORD

i. Oil pressure . . . . . . 40 to 50 psi . . . . RECORD

2. Automatic Flight Control System (AFCS)

NOTE

Turn AFCS to STBY position 90 seconds prior to engagement. Perform preflight checkout.

a. Inflight (Stability Augmentation) . . . . CHECK

(1) Engage . . . . NO AIRCRAFT UPSET (RUDDER THUMP ACCEPTABLE)

(2) Pulse Rudder . . . . . . NO APPARENT OSCILLATION REMAINING AFTER 2 CYCLES

(3) Disengage . . . . NO AIRCRAFT UPSET (RUDDER THUMP ACCEPTABLE)

b. AFCS – Engage and Disengage Transients . . . . CHECK

(1) Trimmed straight and level flight ±0.5-degree bank upset. No pitch upset.

(2) Trimmed flight not straight and level . . . . BANK ANGLE LESS THAN 70 DEGREES, ±2.0 DEGREES BANK UPSET.

PITCH ANGLE LESS THAN 60 DEGREES, ±0.5G PITCH UPSET.

c. Heading Hold Mode . . . . CHECK

(1) Will not engage (no force on control stick . . BANK ANGLE OVER 7.0 DEGREES (ALL-ATTITUDE INDICATOR READING).

(2) Must engage (no control stick) . . . . . . BANK ANGLE UNDER 3.0 DEGREES (ALL-ATTITUDE INDICATOR READING).

(3) Upon engagement . . . . WILL SEEK AND HOLD ENGAGE HEADING ±1.0 DEGREE.

d. Attitude Hold Mode . . . . CHECK

(1) Hold established pitch angle (within 60 degrees noseup to 60 degrees nosedown) . . . . ±1.0 DEGREE

(2) Hold established bank angle (within 5 to 70 degrees left or right) . . . . ±2.0 DEGREES

e. Preselect Heading (PSH) Mode . . . . CHECK

(1) Upon engagement . . . . AIRCRAFT SHOULD TURN IN THE DIRECTION FOR SMALLEST HEADING CHANGE

(2) During turn . . . . BANK ANGLE 27±5.0 DEGREES ESTABLISHED BANK AND PITCH ANGLES REMAIN CONSTANT ±2.0 DEGREES.

(3) During rollout . . . . . . ROLLOUT COMPLETED TO SELECTED HEADING WITHIN 20 SECONDS AND BANK ANGLE EVER DECREASING.

(4) Following rollout . . . . ESTABLISHED HEADING SHOULD BE ±1.0 DEGREE OF PRESELECTED HEADING.

(5) Disengage PSH switch during turn . . . . AIRCRAFT RETURNS TO APPROXIMATELY WINGS-LEVEL FLIGHT WITHIN 20 SECONDS.

(6) Maximum rate of roll at any time while on PSH mode . . . . 40 DEGREES PER SECOND

f. Altitude Hold Mode . . . . CHECK

(1) Will not engage . . . . . STEADY STATE CLIMB OR DIVE OVER 4500 FPM.

(2) Must engage . . . . STEADY STATE CLIMB OR DIVE UNDER 3500 FPM.

(3) Damping upon engagement during climb or dive . . . . 1 CYCLE TO 1/10 AMPLITUDE OR TO AMPLITUDE OF RESIDUAL OSCILLATION, II.H.2.f.(5), WHICHEVER IS GREATER.

(4) Load factor during damping . . . . ±0.5G FROM STEADY STATE LOAD FACTOR AT ENGAGEMENT.

(5) Residual oscillation . . . . AMPLITUDE IN II. H. 2. f(6) WITH MAXIMUM FREQUENCY OF 3 CPM.

(6) Holds engage altitude when engaged in level flight (bank angle less than 15 degrees . . . . . ±25 FEET OR ±0.5 PERCENT OF ALTITUDE

g. Control Stick Steering (CSS) Mode . . . . CHECK

(1) CSS breakout force

Long./Lat . . . . 2±0.5 POUNDS

(2) CSS stick force

Longitudinal . . . . 50 TO 120 PERCENT OF NORMAL SYSTEM FORCES

Lateral . . . . 80 TO 120 PERCENT OF NORMAL FORCES

(3) Feedback . . . . QUALITATIVE EVALUATION. AIRCRAFT UPSETS SHOULD NOT EXCEED LIMITS IN II. H. 2. h. (1).

NOTE

Feedback is defined as follows:

A lateral oscillation of the control stick, 1 to 3 cps, that the pilot feels and sees while maneuvering the aircraft in the lateral direction in the CSS mode. This does not include any transients caused by CSS engagement or disengagement (CSS "Break-in or Breakout").

h. Residual Oscillations . . . . CHECK

(1) With hands off control stick while using heading hold, PSH or attitude hold modes. . . ±0.5 DEGREE LATERAL AT APPROXIMATELY 2 TO 4 CPS. NO PITCH OSCILLATION.

(2) Due to external lights (flashing) . . . . . ±0.75 DEGREE LATERAL AT APPROXIMATELY 1 CPS. NO PITCH OSCILLATION. RESULTANT STICK MOTION ACCEPTABLE.

i. Automatic Pitch Trim. . . . . CHECK

Time lag for trim operation after new attitude is established, and period between operations is 5±2 seconds (no transients).

j. Structural Protection Subsystems (Longitudinal) . . . . CHECK

(1) Windup turn on CSS mode without centerline store. . . . . DISENGAGE 4±0.5G

With centerline store . DISENGAGE 3.5±0.5G

(2) Attitude hold mode . . . . DISENGAGE $^{3.5\pm0.5G.}_{-1.0\pm0.5G.}$

THE LOAD FACTOR MONITOR SHOULD DISENGAGE THE AFCS WHENEVER LONGITUDINAL SURFACE RATES EXCEED 20 DEGREES PER SECOND.

(3) Lateral (Qualitative only) . . . . AFCS SHOULD DISENGAGE WITH APPROXIMATELY 1/2 STICK THROW OR 1/2 AILERON THROW WITH MAXIMUM 40 POUNDS STICK FORCE.

k. Speedbrake Compensation . . . . CHECK

(1) With AFCS engaged, open speedbrakes. . . . ±0.5G MAXIMUM PITCH

(2) With AFCS engaged, close speedbrakes . . . ±0.5G MAXIMUM PITCH

J. 10,000 FEET AND BELOW

1. APN-141 Radar Altimeter . . . . CHECK

a. Allowable altitude error. . . . . 0 TO 100±5 FEET 100 TO 5000 FEET ±5 PERCENT

b. Aircraft operating limits

(1) Dropout should not occur at pitch angle less than 50 degrees or bank angle less than 30 degrees.

(2) Groundspeed . . . . 0 TO 100 FEET, 500 KIAS MAXIMUM 100 TO 5000 FEET ±5 PERCENT

c. Operation

(1) 10 to 5000 feet. . . . . . SMOOTH TRACKING OF TERRAIN CLEARANCE WITHOUT FLICKER OF OFF FLAG.

(2) 6000 to 10,000 feet. . . POINTER REMAINS BEHIND MASK. OFF FLAG IS IN VIEW.

(3) Above 20,000 feet . . . . POINTER REMAINS BEHIND MASK. OFF FLAG IS IN VIEW.

(4) Warning light . . . . . . ON WHEN AIRCRAFT IS BELOW PRESET TERRAIN CLEARANCE ALTITUDE ±10 FEET OR 100 PERCENT WHICHEVER IS GREATER

(5) Self-test . . . . DEPRESS CONTROL KNOB AND INDICATOR READS 5±5 FEET. (AIRCRAFT BELOW BAROMETRIC SWITCH CUT-OUT ALTITUDE.)

2. Low-Level Flight

a. Aircraft must be directionally trimmed to V maximum, 300 KIAS and over, rudder trim to be 0±1.0 degree.

b. Carrier approach check 6000 feet at 150 KIAS approximately 75 percent rpm (gear and flaps down):

(1) Jam Acceleration

Time: 75 percent rpm to (military), 5 seconds maximum . . . . RECORD

EGT

(J52-P-6A) . . . . 650°C maximum for 8 minutes . . . . . RECORD

610°C maximum stabilized . . . . . RECORD

(J52-P-6B) . . . . 660°C maximum for 8 minutes . . . . . RECORD

621°C maximum stabilized . . . . . RECORD

(J52-P-6A/B). . . 680°C maximum for 8 minutes . . . . . RECORD

650°C maximum stabilized . . . . . RECORD

3. Speedbrakes . . . . CHECK

a. Extend speedbrakes by EMER SPEEDBRAKE knob and retract.

4. Radar. . . . . CHECK

NOTE

Radar must by in STBY 90 seconds prior to power switch to desired operating mode.

a. At 2500 ft check mode-search, range-long, level flight. Turn indicator gain control clockwise until "grass" appears on indicator, then ccw until "grass" just fades out. Vary antenna tilt control for maximum targets.

(1) Approximate maximum target range . . . . RECORD

(2) Radar antenna tilt setting . . . . RECORD

(3) Altitude . . . . RECORD

(4) Type of terrain . . . . RECORD

b. Radar to SRCH mode and check terrain clearance, profile, short range. Aircraft altitude to 1500 ft:

(1) Increase indicator gain until a broad band of video appears.

(2) Adjust gain using target signal near maximum range of radar until video is 5° in vertical height.

(3) Turn detail control cw until video appears as a narrow band approximately 3° wide and record the following:

(a) Video below T/C line (1500 ft).

(b) Obstacle warning light out.

(c) As aircraft altitude is decreased to 1000 ft, video rises toward T/C line.

(d) As aircraft descends below 1000 ft, video passes through T/C line, obstacle warning light ON, warning tone in headset.

(4) Radar to OFF.

5. Fuel Dump . . . . CHECK

CAUTION

Dumping wing fuel above the freezing level may result in the dump valve freezing open. Fuel dump will then continue until the wing tank fuel is depleted or descent is made below the freezing level.

a. Turn on FUEL DUMP

(1) Note drop in internal fuel quantity and slight buffet from fuel leaving the dump mast.

b. Secure FUEL DUMP

(1) Fuel quantity should stabilize and the slight buffeting cease.

III. Flight Control Disconnect Procedures (Rate-of-Roll Check)

NOTE

The required flight control disconnect, whether due to wing control surface rework or other reasons, for carrier based aircraft shall be performed at the discretion of the squadron Commanding Officer.

WARNING

Do not attempt flight control disconnect check if operating on emergency generator except in case of an emergency.

This procedure is designed to be performed in conjunction with the normal flight check procedure. Items repeated, which are part of the normal procedure are those which are exceedingly important in the proper performance of this check or those where additional checks are necessary which would not be performed in the normal flight check procedure.

GROUND CHECK PROCEDURE

NORMAL TRIM CONTROL CHECK. After start, when all systems normally required for flight are functioning on aircraft power, the normal trim control checks of the elevator, rudder, and ailerons should be performed to ensure proper operation. During the actuation of these trim systems the pilot should be assisted by ground personnel, using predetermined signals, to ensure correlation between trim settings and cockpit trim indicators.

MAXIMUM AILERON FOLLOWUP TAB DEFLECTION. In addition to the normal trim system check, when a power disconnect is to be performed, the aileron followup tab may be checked at the 3-degree up and the 3-degree down position. This is the maximum deflection allowable for intentional, inflight, power disconnect, as an aid in visually determining this limit prior to attempting a disconnect when airborne. Three degrees deflection of the followup tab (from faired with the aileron) is difficult to determine from the cockpit, even when on the ground. Therefore, ground personnel should be briefed as to what is required, and using a means of definite measurement, assist the pilot in obtaining these settings (3-degree deflection of the followup tab from faired with the aileron is approximately 1/5 inch).

Checking the followup tab at the 3 degrees up and down position prior to taxi is not part of the required ground check procedure for a power disconnect flight, but is suggested to aid the pilot in establishing a picture of what 3-degree followup tab deflection may look like in flight prior to attempting a disconnect.

RIGGING CHECK. Prior to taxi, and as part of the normal trim and rigging check, the following procedures should be accomplished:

1. Assisted by ground personnel, trim both ailerons symmetrically (i.e., both above or below an equal amount relative to the wing).

2. Check the aileron followup tab a maximum of 3 degrees (1/5 inch) deflection (from faired with the aileron) when the ailerons are trimmed symmetrically.

3. Check the control stick for centering (vertical) when the ailerons are trimmed symmetrically with the wings.

4. Actuate all controls for maximum deflection and check for ease of movement to ensure that all systems are connected and functioning normally.

NOTE

If the control system does not meet the requirements of the above checks, it is probably out of rig and the aircraft should not be flown.

AIRBORNE TEST PROCEDURE

WIND CONDITIONS AT LANDING FIELD. A crosswind component of 8 knots will be considered maximum for a safe disconnect landing. The disconnect check will not be performed if a stronger component exists. When contacting the tower or ground control, the pilot should request the wind in degrees magnetic, velocity, and other pertinent information such as forecast wind shift, duty runway, or into-wind runway availability, and gusts. It should always be

anticipated that disconnecting will result in reduced control of the aircraft, and if any condition exists which would further complicate the landing, the check should not be performed.

After contact with the tower has been established and the duty runway has been determined proceed as follows:

NOTE

Prior to performing a hydraulic power disconnect under controlled conditions, the emergency generator should first be extended and a functional check of the emergency trim override should be made. If the emergency trim functions properly on emergency generator, switch to BYPASS and continue with disconnect.

1. Establish altitude of 15,000 feet, or above, with a minimum amount of fuel in the wing. Fifteen thousand feet is established as a minimum safe altitude for performing the check in the event of a momentary uncontrollable rate-of-roll. The wing tank should be as near empty as practicable to preclude fuel displacement to the descending wing and resultant increase in rate of roll.

Under NO circumstances will the disconnect check be performed with an asymmetrical wing loading. It may be necessary to perform the check with external drop tanks installed, but it should be assured that they are empty prior to disconnect.

2. Trim for hands-off, straight and level flight at 300 KIAS. The aircraft should be in the clean configuration.

3. Visually check the followup tab for 3-degrees maximum deflection from faired with the aileron (port aileron). Three degrees deflection of the followup tab from faired with the aileron is approximately 1/5 inch and may be determined during the normal preflight check as outlined previously. This 3-degree limit applies to all present models of the aircraft. If the followup tab is deflected more than 3 degrees when the aircraft is trimmed for hands-off, straight and level flight at 300 KIAS, the hydraulic system should not be disconnected, as an excessive rate of roll will probably occur.

4. Without retrimming, slow to 200 KIAS. Be careful not to retrim the aircraft during deceleration. The rate-of-roll check must be performed at 300 KIAS with the trim necessary for hands-off, straight and level flight at that speed. The deceleration to 200 KIAS for the actual disconnect is for safety, in that an excessive rate of roll is more controllable at slower speeds, and there is less chance of overstressing the aircraft should an erratic condition occur.

Deceleration should be accomplished without the use of speedbrakes if possible. The speedbrakes are directly connected to the elevator control and a possible trim change may occur due to extension and retraction.

5. Pull power disconnect handle. The power disconnect should be pulled smartly to ensure proper disconnect. Pulling the handle slowly may result in a partial disconnect which could cause a hazardous flight condition or erratic rate of roll.

Normally, the disconnect cable will extend approximately 12 inches for a complete disconnect, and two slight jolts will be felt, evidencing the disconnect of the aileron and elevator hydraulic systems in that order. Once again it is emphasized that the boost disconnect handle should be pulled smartly, and no hesitation between each system disconnect should be attempted.

CAUTION

Hold the T-handle while allowing handle to return to the stowed position. This procedure is to prevent handle striking an instrument.

After disconnect, no trim should be used if the aircraft is controllable. If an excessive rate of roll or pitch condition exists at the present speed, and the pilot considers that the aircraft may become uncontrollable at higher airspeed, no attempt should be made to perform the rate-of-roll check. In this condition, if the pilot feels able to control an excessive rate of roll at 200 KIAS, the check may be performed the same as for the 300 KIAS check; but the angle of bank should not be allowed to exceed 30 degrees. Although not as desirable as if performed at 300 KIAS, this rate of roll will enable ground personnel to make some corrective adjustment. In this case, after the rate of roll has been recorded, the aircraft should be flown "slow-flight" in the landing configuration and retrimmed if necessary for a safe landing. Speeds in excess of 200 KIAS should not be used for the remainder of the flight.

In the event the aircraft becomes uncontrollable after disconnect at 200 KIAS, an emergency condition exists and the check should be abandoned. Trim should be used immediately in an attempt to stop the roll and regain control, and the throttle should be retarded to idle to reduce airspeed.

In the case of excessive nosedown pitch, it should be remembered that use of the speedbrakes may cause an increased nosedown tendency due to the design of the system.

6. Accelerate to 300 KIAS. Under normal conditions the rate-of-roll check should be performed at 300 KIAS, since the aircraft was trimmed for hands-off, straight and level flight at this speed, and it is the rate of roll after disconnect at this speed that is to be determined.

During the acceleration, straight and level flight should be maintained without use of the trim system since this will destroy the conditions for a proper rate-of-roll check. If the control forces become so severe during acceleration that control of the aircraft during an excessive rate of roll is doubtful, the check should be discontinued or performed as described in step 5.

7. RECORD rate or roll at 300 KIAS. When stabilized at 300 KIAS, wings level, time the rate of roll by means of the elapsed time clock and reference to the gyro horizon. Do not allow the aircraft to exceed 60 degrees of bank. An angle of bank in excess of 60 degrees may allow the aircraft to "fall through," increase bank rapidly, and in the case of an excessive rate of roll, cause the aircraft to become uncontrollable before corrective action can be taken.

Return the aircraft to the wings level attitude without use of trim, if possible, and repeat the check to ensure an accurate rate-of-roll recording. Four and one-half degrees per second, the maximum allowable rate-or-roll, is very slow and an error in timing is possible during the initial attempt.

8. Retrim for hands-off, straight and level flight at 300 KIAS. After determining the direction and rate of roll, the aircraft should be returned to straight and level flight and retrimmed to maintain this condition.

NOTE

If aircraft can be controlled laterally, do not retrim ailerons since the original aileron position will aid maintenance personnel in correcting roll-rate discrepancies.

9. After the aircraft has been retrimmed at 300 KIAS, note and record the deflection angle of the followup tab and the aileron. This trim check should be performed as near handsoff stick as possible in straight and level flight. Decelerate and perform a simulated landing approach. In decelerating prior to performing the simulated approach, use should be made of all systems which may be needed in the actual landing (speedbrakes, landing gear, flaps) to determine any adverse effects they might have on the control of the aircraft. Safety is of primary importance throughout the entire disconnect check, and if aileron trim is necessary after disconnect or during the landing for any reason, the pilot should not hesitate to retrim.

10. Prior to landing, the stability augmentation switch on the AFCS control panel should be placed in the STAB AUG position, and the spoiler switch placed in the ARM position.

Upon completion of the flight, a notation should be made on the Discrepancy Report that the hydraulic system was disconnected; and of the direction and rate of roll, if any, and any adverse flight conditions resulting from the disconnect. This information and any pertinent remarks, which may aid other pilots or maintenance personnel in the future, should be entered in the aircraft logbook.

IV. Approach and Landing

A. DURING LANDING

1. Radar altimeter for low altitude operation . . . . CHECK
2. Angle-of-attack system for landing configuration . . . . CHECK
3. Brake operation on rollout . . . . CHECK
4. Ground control characteristics . . . . . . CHECK

V. After Landing

A. AFTER FLIGHT REQUIREMENTS

1. Amount of oxygen used and evaluate consumption . . . . CHECK
2. Engine oil quantity . . . . CHECK
3. Shutdown engine.
4. Observe engine rundown time . . . . CHECK

   Rundown time should be:

   N_1 (low-pressure compressor) . . . . 30 to 60 seconds (approximately)

   N_2 (high-pressure compressor) . . . . 50 to 80 seconds

5. Before leaving aircraft, complete procedures for securing the aircraft.
6. Properly post all discrepancies or maintenance action requirements on appropriate forms.

PART 4
CARRIER-BASED PROCEDURES

GENERAL

The CVA/CVS and LSO NATOPS manual is the governing publication for carrier-landing operation.

DAY OPERATIONS

Preflight

Preflight, start, and poststart checks shall be accomplished in accordance with section III, part 3, with the following additions:

1. Record the expected gross weight of the aircraft for catapult launch in the designated area.

2. Ensure that the tension-bar retainer clip is installed securely and is in good condition.

3. Note the relationship of arresting hook to deck edge. Do not lower hook during poststart checks unless hook point will drop on the flight deck.

Poststart

1. Engines will normally be started 10 to 15 minutes prior to launch, and the customary functional checks will be performed.

2. The canopy will be either open or fully closed and locked. It should be closed when necessary to prevent damage from wind or jet blast.

3. Set emergency-jettison select switch to appropriate position prior to launch.

Taxi

WARNING

Spoilers shall be dearmed during shipboard operations because of potential hazard to flight deck personnel.

CAUTION

Taxi with flaps fully retracted.

1. Taxiing aboard ship is generally similar to that on land, with some variation of power required due to increased wind and turbulence and decreased braking effectiveness because of higher tire pressures. Particular attention should be given to keeping speed under control.

2. While taxiing with appreciable wind over the deck, pilots should avoid attempts to turn large angles to the relative wind or to the jet blast of another aircraft. However, it is imperative that the director's signals be followed closely at all times.

3. Under high wind conditions, directional control is sometimes difficult. Primary control for taxiing will be nosewheel steering augmented by brakes. If the nosewheel cocks, add throttle to 70 to 80 percent and use rapid intermittent brake to bounce the nose strut, while moving slowly forward. This should decrease the weight on the nosewheel long enough for it to swivel in the desired direction. If this procedure is not effective, hold brakes, retard throttle to IDLE, and signal for a tiller bar. Normally, under heavy crosswind conditions, a tiller bar and wing walkers should be provided.

WARNING

If a tiller bar is being used, use both brakes together and with equal pressure. Using brakes singly can injure the tiller bar man. Do not use nosewheel steering while tiller bar is on aircraft.

Catapult Launches

Proper positioning on the catapult is easily accomplished by maintaining a slight amount of excess power and using the brakes to control speed. The pilot must anticipate the initial "hold" immediately after the nosewheel drops over the shuttle, followed

by a "come ahead" as the holdback unit is placed on the tension bar. After the nosewheel drops over the shuttle, the pilot must move ahead very slowly to prevent overstressing the tension bar. Upon receipt of the "release brakes" signal from the catapult director, release brakes and immediately increase power to MILITARY. Observe acceleration time and allow engine to stabilize.

NOTE

Wind has a negligible effect on EPR readings.

Recheck the attitude gyro, RMI, engine instruments, trim indicators, and flap setting. Ensure a firm grip on the throttle and catapult handgrip, place your head against the headrest, salute, and wait. Normally, the catapult will fire 3 seconds after the launching officer gives the "fire" signal.

TECHNIQUE

Prior to launch, select the optimum trim settings for the anticipated endspeed and aircraft loading. The control stick, if unrestrained by the pilot, will move to the full aft position at the beginning of the catapult power stroke and return to the trimmed position by the end of the power stroke. The proximity of the control stick handgrip to the pilot, and pilot physical geometry, make it difficult to fully brace the arm while holding the stick in the trimmed position during high acceleration launches. The recommended technique is to cup the hand just aft of the stick and restrain as much arm movement as possible by pressing the arm against the side and/or thigh. As soon as practicable after end of power stroke, grasp the stick in its pretrimmed position (optimum horizontal stabilizer setting) and allow aircraft to rotate to a fly-away attitude with a minimum of fore/aft stick movement. The pilot must avoid any large longitudinal control movements as the aircraft becomes airborne, yet be prepared to make minor attitude corrections as necessary and correct any aircraft wing drop that may occur. An initial attitude of approximately 12 degrees noseup is recommended. Adjust attitude as necessary for climbout; normally this will be about 12 to 14 degrees noseup on the attitude gyro. Cross-check angle of attack, airspeed, and other appropriate instruments. Do not rely solely upon one instrument. Ensure a positive rate of climb. Retract flaps at 170 KIAS minimum.

OPTIMUM TRIM SETTINGS

1. Rudder . . . . ZERO DEGREES
2. Aileron . . . . FAIRED
3. Horizontal stabilizer:

   Basic trim at 0 to 10 KIAS excess endspeed:

   Full flaps. . . . . 7.5 DEGREES

   Half flaps. . . . . 7.0 DEGREES

   Basic trim at 11 to 40 KIAS excess endspeed:

   Full/half flaps . . . . 6.0 DEGREES

TRIM SETTINGS FOR ASYMMETRICAL LOADINGS.

Asymmetrical bow catapult launches with up to 5120 foot-pounds of static moment are permitted. The following trim and control inputs are recommended for the listed crosswind conditions.

Allowable crosswind (knots)	Required endspeed above minimum (KIAS)	Rudder trim units (away from loaded wing)	Aileron
0 to 5	0 to 3	2	Faired
6 to 10	4 to 6	2	Faired
11 to 17 (max)	7 to 10	3	Faired

NOTE

Approximately 5 pounds of lateral stick force is required with 0 to 10 KIAS crosswind and one-quarter to one-half lateral stick deflection is required with 10 to 17 KIAS crosswind to maintain wings level after leaving the bow.

AIRCRAFT OR CATAPULT MALFUNCTION

If, after established at MILITARY POWER, the pilot determines that the aircraft is down, he so indicates to the launching officer by SHAKING HIS HEAD FROM SIDE TO SIDE. NEVER raise the hand into the catapult officer's view to give a "thumbs-down" signal. It is possible that the launching officer may construe the signal to be a salute and fire the catapult. When the catapult officer observes the "NO-GO" signal, he should immediately give a suspend signal. If his response is not immediate, call on land/launch frequency "Suspend, suspend."

Landing Pattern

Under VFR conditions, the formation shall approach the breakup position in right echelon, close aboard the carrier on the starboard side, parallel to the Base Recovery Course (BRC) at 800 feet and 250 KIAS. A minimum straight-in of 3 miles is desired for VFR entry to the break. Aircraft shall be in parade formation with hooks down. Breakup should commence when past the bow and adequate interval on downwind traffic is assured. Normally, a 17-second break interval will establish a 35-second ramp interval. Close adherence to pattern details by all pilots is required for uniform landing intervals. The pattern given in figure 3-7 is recommended. Each pilot shall have the landing checklist completed, be at optimum AOA/approach speed, and have the wheel brakes checked by the 180-degree position. Speedbrakes will normally remain out throughout the approach and landing. Use of speedbrakes may not

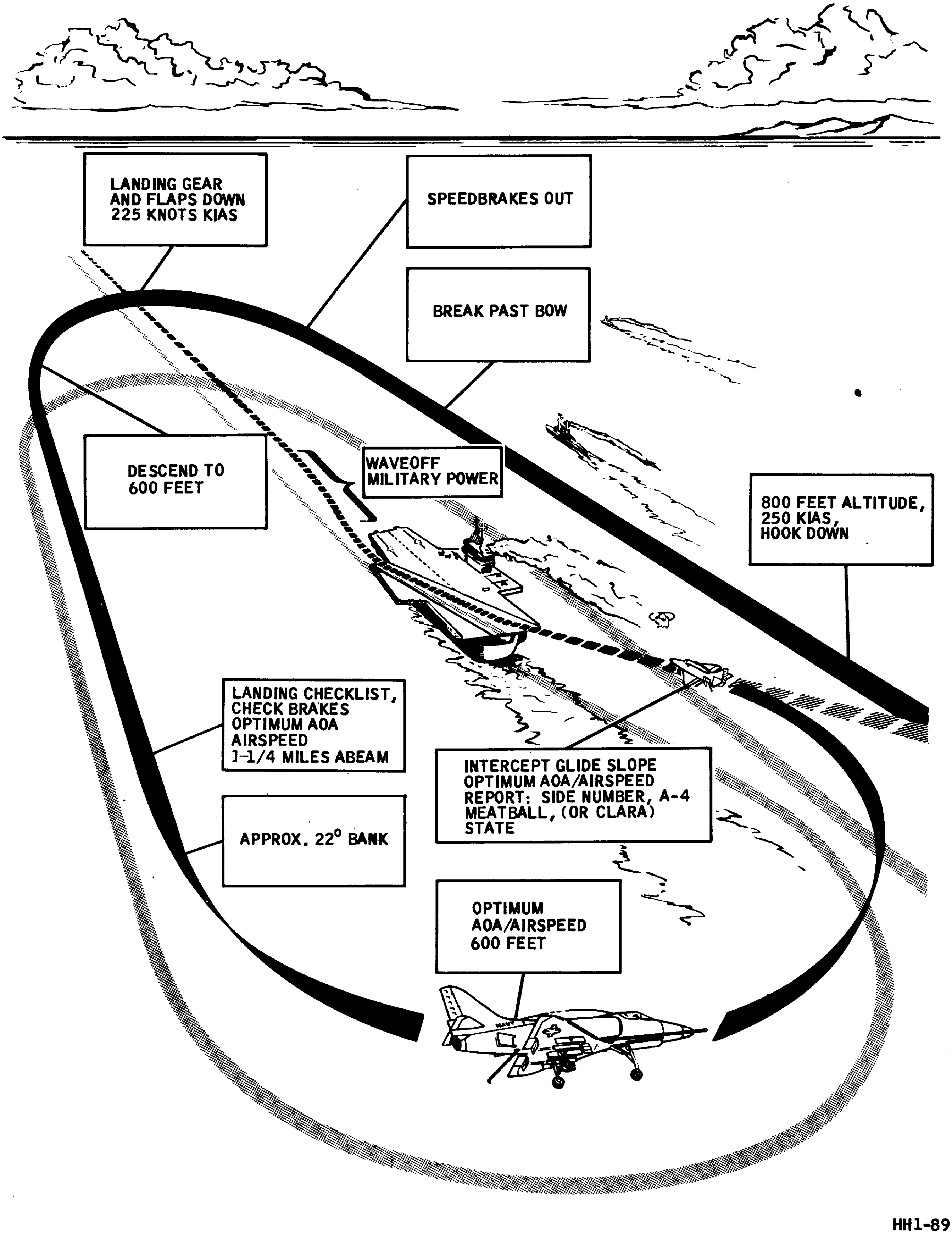


Figure 3-7. Typical Carrier-Landing Pattern

be desirable at high gross weights (in excess of 14,000 pounds) when configured with high drag stores, i.e., buddy store, MER's, etc., due to the high thrust required during the approach.

WAVEOFF

To execute a waveoff, immediately add full power, retract speedbrakes, and maintain optimum attitude. Make all waveoff's straight up the angled deck.

CAUTION

Rotation of the aircraft to an exaggerated nose-high attitude on a waveoff lowers the arresting hook beyond its normal reach and can result in an in-flight engagement. The resulting arrestment can cause damage to the aircraft. Over-rotation on a waveoff can also place the aircraft on the back side of the power-required curve where sufficient power is not available to stop the descent.

Arrested Landing and Exit from the Landing Area

Upon touchdown, advance the throttle to MILITARY and retract the speedbrakes. After arrestment is assured, retard the throttle to IDLE and raise the hook and flaps. The aircraft should be allowed to roll back a short distance after arrestment to permit the hook to disengage from the pendant. Hold both brakes when signaled by the director, apply power (about 70 percent), and engage nosewheel steering (A-4F), in anticipation of the "come-ahead" signal, unless pull-back is indicated by the director. If pull-back is directed, retard the throttle to IDLE, release brakes, and allow the aircraft to be pulled back until a brake signal is received. Then, apply brakes judiciously to prevent the aircraft from tipping or rocking back. Anticipate the "come-ahead" signal by adding power to about 70 percent.

CAUTION

Cross the foul line and follow the director's signals. The usual wind over the deck will give a substantial crosswind component while taxiing on the flight deck. Wing walkers should be provided to assist in leaving the landing area when there is a severe crosswind or wind over the deck exceeding 40 knots. Water, oil, and hydraulic fluid spillages on the flight deck require that caution be exercised in using power and brakes.

Postlanding Procedures

As long as the aircraft is taxiing, the canopy should remain closed and the pilot shall keep his helmet and oxygen mask on. Prior to shutdown, he will open the canopy. If the aircraft is towed or pushed, he shall keep speed slow and under control, and, as noise level is normally high, he must remain alert for either hand or whistle signals from aircraft handling personnel. Whenever the plane director is not in sight, STOP: Do not release brakes until the aircraft has at least an initial tiedown. Plane captains shall not install the access ladder until this has been accomplished.

NIGHT OPERATIONS

Flight Deck

PREFLIGHT

External preflight will be made using a red-lens flashlight. In addition to normal cockpit preflight, ensure that external light switches are properly positioned for poststart exterior lights check. The master exterior lights switch, anticollision light switch, and the taxi light switch should always be in the OFF position prior to start. Wing lights and taillights should be set to BRT/STDY position for the poststart checks. Instrument lights and console lights control should be turned on. Direct cockpit emergency floodlights on instrument panel and kneeboard light as desired.

POSTSTART

Adjust cockpit lights intensity to desired level. After normal systems checks are completed, perform exterior lights check. Place the master exterior lights switch in ON momentarily. Upon completion of exterior lights check, place master exterior lights switch in the OFF position.

TAXI

Slow and careful handling of aircraft by both the plane director and the pilot is mandatory. If the pilot has any doubt as to the plane director's signals; STOP.

CATAPULT LAUNCHES

The difficulty of "getting on" the catapult at night is increased by the fact that it is difficult for the pilot to determine his speed. The pilot must rely upon, and follow closely, the directions of the plane director.

As the aircraft approaches the catapult, the plane director should position himself forward and remain stationary to give the pilot a visual reference for controlling taxi speed as the aircraft approaches the shuttle.

Upon receiving the signal from the catapult director, release brakes. Immediately increase power to MILITARY in anticipation of the turnup signal from the launching officer.

NOTE

Wind has a negligible effect on EPR readings.

When satisfied that the aircraft is ready for launch, the pilot so signifies by placing the master exterior lights switch in the ON position. The pilot must be prepared to establish a wings-level, climbing attitude on instruments. An initial attitude of approximately 12 degrees noseup is recommended. Cross-check angle of attack, airspeed, and other appropriate instruments. Do not rely solely upon one instrument. Ensure a positive rate of climb is obtained. Retract the landing gear at 300 feet or above. Retract flaps at 170 KIAS or above. During night launches, do not make clearing turns. At 2500 feet or higher, adjust exterior lights as briefed.

AIRCRAFT OR CATAPULT MALFUNCTION. The pilot's "NO-GO" signal for night catapult launch consists of not turning his exterior lights ON. The pilot should call on land/launch frequency "Suspend, suspend." Maintain MILITARY power until the launching officer gives the "throttle-back" signal.

Do not turn exterior lights ON unless completely ready to be launched.

Landing Pattern

Night and instrument recoveries normally will be made utilizing TACAN/CCA approaches in accordance with the CVA/CVS NATOPS Manual.

ARRESTED LANDING AND EXIT FROM THE LANDING AREA

The LSO will normally take control when the aircraft is approximately 1 mile from the ramp. The pilot should have exterior lights set in accordance with Air Wing doctrine. Following arrestment, immediately place master exterior lights switch to OFF. Taxi out of the landing area slowly. Do not stare fixedly at the plane director's wands but use them as the center of the scan pattern.

Carrier-Controlled Approach (CCA)

GENERAL

The pattern procedures, and terms used for carrier-controlled approaches shall be in accordance with the CVA/CVS NATOPS Manual.

PROCEDURES

A CCA approach is similar to a straight-in jet penetration. Lower the hook entering the holding pattern and maintain maximum endurance airspeed. Single aircraft must leave the Marshal point at estimated approach time (EAT). If the flight consists of two or more aircraft, the Flight Leader normally should plan to be in holding at Marshal in time to make a half standard-rate 180-degree left turn, break off from the flight, and return to the Marshal point at his EAT. Subsequent aircraft in the flight break at 30-second intervals. As each pilot reaches Marshal, he commences his letdown at 250 KIAS, 4000 fpm rate of descent, speedbrakes OUT, and about 80- to 82-percent RPM. At 5000 feet (platform), the rate of descent is reduced to 2000 fpm, although penetration speed is maintained at 250 KIAS. Level off at 1200 feet, retract speedbrakes, and adjust power to maintain 250 KIAS to the 10-mile gate. At this point, transition to 150 KIAS by retarding the throttle to 70 percent. Extend speedbrakes and drop wheels and flaps as airspeed drops below 225 KIAS. Retract speedbrakes and adjust power to maintain 150 KIAS. Aircraft shall be in landing configuration prior to reaching the 6-mile gate. Unless otherwise directed, maintain 1200 feet and optimum approach speed until directed to commence descent at about 2 3/4 miles. Then extend speedbrakes, and maintain optimum AOA/airspeed.

After transition is made to landing configuration, all turns should be standard rate. Do not exceed 30 degrees bank at any time. Do not exceed 15 degrees bank below 600 feet on final approach.

SECTION CCA

A section CCA may be necessary in the event a failure occurs affecting navigation aids, communications equipment, or certain other aircraft systems. Normally, the aircraft experiencing the difficulty will fly the starboard wing position during the approach. The lead aircraft should fly a slightly faster approach (about 10 knots above optimum AOA/airspeed) to afford the wingman some comfort and latitude in power control. If leading a dissimilar type aircraft comply with Air Wing doctrine.

The section leader will detach the wingman when the meatball is sighted and continue straight ahead, offsetting as necessary to the left to determine if the wingman lands successfully. The leader shall commence a slow descent to not lower than 300 feet altitude and adjust exterior lights in accordance with Air Wing Doctrine to provide the wingman with a visual reference and a leader should the wingman bolter or waveoff. The wingman should not detach unless he has the meatball in sight. Necessary visual signals are contained in figure 7-9.

WAVEOFF/BOLTER PATTERN

Waveoff will be straight up the angled deck, when given close-in. Pilots must bear in mind that during a late waveoff, an in-flight engagement is possible, therefore the aircraft must be lined up with the centerline to reduce the possibility of aircraft damage. After a waveoff or a bolter, establish a positive climb and maintain the approach final bearing. DO NOT CROSS THE BOW while flying upwind. Be alert for other aircraft launching from the catapult or entering the pattern from the break. The aircraft ahead will have priority for the turn downwind. If in doubt, use the radio. A waveoff to the right will be made when overshooting the landing line to the extreme. When waving off to the right, remain well clear of the planeguard helicopter.

Carrier Emergency Signals

See CVA/CVS NATOPS Manual for emergency signals from carrier to aircraft.

SHORT AIRFIELD FOR TACTICAL SUPPORT (SATS) PROCEDURES (A-4E only)

General

A-4 SATS catapult operations are limited to a minimum gross weight of 18,000 pounds, density altitude ranges from -2000 to +2000 feet, and no more than 15 knots of direct crosswind.

Day Operations

GENERAL

Preflight, start and poststart checks shall be accomplished in accordance with normal field procedures and the additions noted.

PREFLIGHT

1. On the nose gear door, record the expected gross weight of the aircraft for catapult launch.

2. Ensure that the tension bar retainer clip is in good condition and secured.

START

1. Start engine sufficiently ahead of time to allow for taxi, catapult launches, and rendezvous before proceeding on the assigned mission.

POSTSTART

1. Place the emergency-jettison armament switch in the proper position prior to taxi.

2. Set trim and flaps as follows:

a. Rudder - 0

b. Aileron - 0

c. Longitudinal - 5 units ANU

d. Flaps - Half.

TAXI

1. Taxiing on advanced airfields presents little difficulty if attention is given to keeping speed under control.

2. Taxiing in and out of revetted areas cannot normally be accomplished without the use of the nose tiller bar.

WARNING

If a tiller bar is being used, apply both brakes simultaneously and with equal pressure. Differential braking can injure the tiller bar operator.

3. Wet or oily metal runway and taxiway surfaces require especially slow taxi speeds due to a greatly reduced coefficient of friction. Sharp turns cannot be made and the wheels will slide with moderate braking action.

SATS CATAPULT LAUNCHES

Proper positioning on the catapult is not easily accomplished because of surface irregularities in the holdback and arrester area. If the previously launched aircraft utilized afterburner, expect the area aft of the dolly arrester ropes to be wet and slippery. Approach the launch area slowly and be alert for signals from the taxi director.

WARNING

Do not taxi into the dolly arrester ropes immediately following the launch of another aircraft until the dolly returns and is arrested. Failure of the arrester ropes may occur on dolly rebound. Wait until the dolly returns and is arrested.

1. Approximately 80 to 85 percent rpm is required to taxi up and over the arrester ropes and dolly ramp.

CAUTION

Keep speed under control. Do not use differential braking if a nose tiller bar is used.

2. As the main wheels roll over the arrester ropes, be prepared for immediate braking and power reduction.

3. When the "come-ahead" signal is given by the taxi director, move ahead cautiously to prevent overstressing the tension bar.

4. After the aircraft is properly positioned and the holdback is engaged, the taxi director will signal for the pilot to release the brakes while the catapult is tensioned.

CAUTION

Ensure that the brakes are released before tension is taken.

5. After tension is taken, the taxi director will transfer control of the aircraft to the launch officer who will signal the catapult for prelaunch turnup. When the catapult is ready, the launch officer will signal the pilot for full power. Increase the throttle to MRT, observe acceleration time, and allow the engine to stabilize.

6. Check attitude gyro, RMI, engine instruments, trim indicators, and flap setting. Grip throttle and catapult handgrip firmly.

7. When ready for launch, salute the catapult officer with the right hand, place head against the headrest, observe the green cutoff light, and wait. Launch will occur approximately 3 to 5 seconds after the catapult officer gives the launch signal.

CAUTION

After receiving the signal for full-power turnup, do not allow your hands to appear above the canopy rails unless you intend to salute as a launch signal. Unusual hand movements, such as lowering a helmet visor, will probably result in a premature launch.

TECHNIQUE

1. The low acceleration forces of the SATS catapult make it unnecessary to fully brace the right arm and restrain the stick from movement. Instead, cup the hand just aft of the stick and restrain arm movement by pressing against the side and/or thigh. Upon perceiving the change in the cutoff light from green to amber, grasp the stick and move it to a position slightly aft of trim. Allow the aircraft to rotate to a liftoff attitude (approximately 12 degrees on the attitude gyro) and fly away. The pilot must avoid gross control movements as the aircraft becomes airborne but should be prepared to make any attitude changes required. When safely airborne, retract gear and flaps as appropriate.

2. The A-4 displays an uncontrollable but mild yaw oscillation during SATS catapult launches. The oscillation commences shortly after holdback release and reaches a maximum at bridle shed. The severity of the oscillation increases at the lower gross weights.

CAUTION

Do not attempt to prevent directional oscillation during the power stroke by the use of rudders.

AIRCRAFT OR CATAPULT MALFUNCTION

1. If, after established at MRT, the pilot determines that the aircraft is down, he so indicates to the launching officer by shaking his head from side to side. Never raise a hand into the catapult officer's view to

give a "thumbs down" signal. Simultaneously broadcast "Suspend" to the tower. When the catapult officer observes the "No-Go" signal, he will immediately give a suspend signal.

2. If bridle shed or bridle failure occurs after hold-back release, the pilot will note a sudden loss of acceleration; the dolly will continue to accelerate and move ahead of the aircraft. Wait until the dolly can be seen ahead of the aircraft, then maneuver to the side of the runway to avoid contact with the rebounding dolly. If safe abort or takeoff is not possible and ejection speed has been attained - EJECT.

LANDING PATTERN

Approach the breakup point either individually or in echelon, parade formation, at 250 to 300 KIAS. A 17- to 20-second break interval will provide a 35- to 40-second touchdown interval. Have the landing checklist completed, be at optimum AOA/approach speed, and have the wheel brakes checked by the 180-degree position. Speedbrakes will normally remain out throughout the approach and landing. This may not be desirable at gross weights in excess of 14,000 pounds or when configured with high drag stores. Maximum gross weight for an arrested landing is 14,500 pounds and the maximum crosswind component recommended is 15 knots.

APPROACH

Plan for and execute an on-glideslope, optimum AOA, on-speed approach. Pay particular attention to maintaining the proper airspeed and correct lineup.

WAVEOFF

To execute a waveoff, immediately add full power, retract speedbrakes, and maintain optimum attitude. Make all waveoffs straight ahead until clear of the landing area.

CAUTION

Rotation of the aircraft to an exaggerated nose high attitude on waveoff lowers the arresting hook beyond its normal reach and can result in an inflight engagement.

ARRESTED LANDING

The aircraft should be on runway centerline at touchdown. Aircraft alignment should be straight down the runway with no drift. Upon touchdown, maintain the throttle at the approach position and retract the speedbrakes. When arrestment is ensured, retard the throttle to idle. Allow the aircraft to roll back to permit the hook to disengage from the pendant. When directed by the taxi director, apply both brakes to stop the rollback, and raise the hook and flaps. If further rollback is directed, release brakes and allow the aircraft to be pulled back until a brake signal is given. Then apply brakes judiciously to prevent the aircraft from tipping or rocking back.

CAUTION

Be very careful when taxiing on a wet SATS runway.

BOLTER

Bolters are easily accomplished. Simultaneously close the speedbrakes, apply full power, and retract the arresting gear hook. Smoothly rotate the aircraft to a liftoff attitude and fly away.

WARNING

If landing on a runway with a SATS catapult installed, be careful to prevent engagement of the dolly arrester ropes with the aircraft's tailhook, or structural damage to the aircraft and catapult will result.

Night Operations

GENERAL

This section covers only that portion of night operations significantly different from day operations.

POSTSTART AND TAXI

It is prudent to perform the poststart and taxi phase with the aircraft exterior lights and rotating beacon operating if allowed by local regulations and combat conditions. Wing lights should be on BRT/STDY.

CATAPULT LAUNCHES

Immediately prior to taxi onto the catapult, turn off all exterior lights using the master exterior light switch and the rotating beacon switch. Rely upon and follow closely the directions of the plane director. Upon receiving the signal from the plane director, release brakes as tension is applied. When given the turnup signal by the catapult officer, apply full power, and check acceleration time and instruments. When satisfied that the aircraft is ready for launch, so signify by placing the master exterior light switch in the ON position. Be prepared to establish a wings-level climbing attitude on instruments. An initial attitude of approximately 12 degrees noseup is recommended. Retract gear when above 300 feet, and retract flaps at no lower than 170 KIAS. When climbing through 2500 feet, adjust lights and radio as briefed.

PART 5
HOT REFUELING PROCEDURES

HOT REFUELING PROCEDURES

The following procedures shall be strictly adhered to by pilots and ground personnel when refueling aircraft with the engine running.

NOTE

A-4 aircraft will be hot refueled through the probe only.

Prior to Entering the Pits

1. The pilot will secure all electrical and electronic gear not required for refueling operations.

2. The plane captains shall check for hot brakes. If the aircraft has hot brakes, the plane captain shall direct it away from the pits.

3. All ordnance shall be removed or dearmed in accordance with local regulations. This includes practice bombs with smoke charges installed.

4. Fueling personnel shall check the fuel pits for loose objects which could be ingested into engine.

5. The aircraft will be taxied into the fuel pits under the guidance of a qualified plane director.

Prior to Refueling

1. The aircraft will be chocked.

2. The plane captain shall attach grounding wire to aircraft before any other connections are made.

3. The pilot will close and lock the canopy and select ram air. The radio will be set on ground control or, if aboard ship, other appropriate frequency.

4. Drop tank pressurization switch shall be placed in OFF position.

5. Switch position.

a. Ensure that AIR REFUEL switch is in NORM position (All A-4F)

b. Ensure FUEL TRANSFER BYPASS switch is OFF (All A-4E reworked per A-4 AFC 317).

CAUTION

Ensure that fuel dump switch is in OFF position prior to refueling.

6. The work stand will be positioned in front of in-flight refueling probe and wheels will be locked.

7. The nozzle operator shall attach nozzle adapter to the probe.

8. The pilot will signal to fuel pit coordinator when he is ready to commence fueling by a "thumbs-up" signal in the daytime and "thumbs-up" illuminated by flashlight at night.

After Commencement of Refueling

WARNING

The plane captain shall visually check drop tanks upon completion of hot refueling to ensure that tanks are either completely full or completely empty. This procedure shall be used whether the drop tank fueling switch has been placed in the ON or OFF position during refueling. In all hot refueling operations, the pilot shall check his external fuel gage to ensure proper fuel load after completion of refueling.

1. Nozzle operator will slowly open valve and check for fuel leaks until the valve is fully open.

2. Immediately upon commencement of refueling, the plane captain will conduct the primary and secondary valve checks in accordance with the Maintenance Instruction Manual (NAVAIR 01-40AVC-2-4.1). If this check is not satisfactory, the refueling operation shall be secured immediately.

3. If the drop tanks are to be filled, either the plane captain shall place the DROP TANK FUELING switch in the ON position, or the pilot shall place the DROP TANK pressurization switch in the FLIGHT REFUEL position.

NOTE

When refueling ashore, gravity fueling method must be used for partial drop tank loads.

4. Appropriately assigned personnel shall monitor vent mast on wing to ensure that it is not obstructed.

CAUTION

If air cannot be felt coming from the vent mast, the refueling operation shall be secured immediately.

5. The pilot will signal the pit coordinator by a cut signal in the daytime and by flashlight at night when refueling is completed. The pit coordinator will signal the nozzle operator and pit operator. The nozzle operator will close the valve on the nozzle but will not remove the probe adapter until the pit operator has evacuated all fuel from the hose.

NOTE

The rotating beacon will be used as an emergency fuel cutoff signal at night.

6. The ground wire shall be detached after all other refueling equipment is removed.

7. A qualified plane director will direct the aircraft out of the pits.

SECTION IV FLIGHT CHARACTERISTICS AND FLIGHT PROCEDURES

TABLE OF CONTENTS

PART 1 FLIGHT CHARACTERISTICS

FLIGHT CHARACTERISTICS

GENERAL

The flight characteristics of the aircraft as described in this section are based, whenever possible, on actual flight test information. In some instances, the results of extensive wind tunnel tests and data from flight tests of similar aircraft are used. Although additional information will be submitted periodically in the form of changes to this handbook, the latest service directives and technical orders concerning this aircraft should be consulted regularly to keep abreast of pertinent information.

Calculations and flight testing indicate that the flight characteristics of the A-4E are the same as for the A-4F aircraft.

The aircraft has the excellent slow flying characteristics usually found in aircraft designed for carrier operations. Positive stability in the power approach configuration (landing gear and flaps down) results in a return to the trimmed condition when disturbed by turbulence or pilot induced displacement.

Flight Controls

AILERONS

Aileron control forces are light at all subsonic speeds when the aileron power system is operative. In the transonic region and above, the air loads on the ailerons become large enough to require the total output of the power control system to deflect the ailerons beyond a certain point.

On manual control, the available rate of roll is markedly reduced at all speeds. Adequate lateral control can be maintained if the speed is reduced below Mach 0.80 or 300 knots, whichever is lower, where a maximum rate of roll of approximately 10 degrees per second is available at sea level. This increases to 40 degrees per second at 40,000 feet.

(Refer to section I, part 2, Hydraulic Power Disconnect, for further information on aileron power disconnect.)

ELEVATORS

The powered elevator provides good control at all speeds. (See figure 4-1, for a powered elevator stick forces diagram.) A bungee is installed in the elevator control system to provide longitudinal load feel. The bungee is linked to the horizontal stabilizer so that the elevator deflects upward (stick moves aft) while trimming noseup and deflects downward while trimming nosedown. The elevator moves approximately 8 degrees as the stabilizer travels from full-throw up to full-throw down.

With the elevator power control system inoperative or disconnected, elevator stick forces will be increased, but for flight at subsonic speeds, adequate control will be available. On manual control, no more than 1.8g can be obtained with the application of 120 pounds of stick force at Mach 0.96 at any altitude. As Mach number is increased, the maneuverability is further decreased. At Mach numbers less than 0.85 and altitudes below 5000 feet, a load factor of 2.7g can be attained with 120 pounds of stick force. Above 5000 feet, and below Mach 0.85, maneuverability is increased and is limited by buffet or accelerated stall.

RUDDER

The rudder power system provides good rudder control at all airspeeds. In the event of hydraulic failure, rudder pedal forces will increase with airspeeds, but very little effort is required at approach and landing speeds. There is no rudder trim available with hydraulic failure.

TRIM SURFACES

The trimming surfaces are capable of reducing stick forces to zero for all stabilized level flight conditions. The horizontal stabilizer will require almost constant repositioning during rapid acceleration and deceleration during takeoff and the approach to the landing.

If the stabilizer actuator should fail while the aircraft is trimmed for high-speed flight, a landing can be accomplished by flying the aircraft onto the runway with the flaps retracted, at an airspeed that assures adequate control. Landing the aircraft with flaps retracted is recommended because of the nosedown trim change that occurs when the flaps are extended. Since the inoperative stabilizer cannot be moved to correct for the trim change, the elevator would have to be employed, in effect reducing the amount of elevator travel remaining to accomplish the landing. Additional elevator effectiveness is available by burning down to 600 pounds of fuel remaining to provide a greater aft cg condition.

Retrimming of the rudder will not be necessary except when asymmetrical drag configurations are encountered, as would occur if two large stores were being carried on the wing racks and one was dropped.

When the aircraft is laterally retrimmed, the aileron trim system actuator relocates the neutral position of the control stick through the aileron power control system. If the power control system fails or is disconnected, the followup tab provides sufficient trim for all flight conditions as long as electrical power is supplied.

SLATS

The wing slats open automatically under various flight conditions to improve airflow characteristics over the wing. As the two slats operate independently, and aerodynamically, one may occasionally open slightly in advance of the other, and impose a rolling movement.

WING FLAPS AND LANDING GEAR

Lowering the wing flaps or landing gear causes a nosedown trim change, while a noseup trim change results from raising either or both. The trim changes are slight and are overcome easily through use of the control surfaces or by retrimming.

SPEEDBRAKES

Operation of the speedbrakes results in changes in trim characterized by a noseup pitch when opened and a nosedown pitch when closed. To counter this characteristic, a speedbrake-elevator interconnect is installed which physically displaces the elevator when the speedbrakes are operated. This interconnect mechanism pulls the control stick forward when the speedbrakes are opened, and returns the stick to its original position when the speedbrakes are closed, thus decreasing the noseup and nosedown pitching. Some trim change will occur when the speedbrakes are operated. The degree of this trim change will be a function of airspeed. For further information on use of the speedbrakes, refer to the paragraph on Diving, in this part.

LEVEL FLIGHT CHARACTERISTICS

Slow Flight

Control is good during slow flight at approach and landing speeds; however, a lateral-directional oscillation is present in rough air.

Cruising

Level flight cruising characteristics are normal, and satisfactory trim and control forces are available. At high altitudes and cruising airspeeds, a lateral-directional oscillation occurs in rough air, which may be counteracted by application of control surfaces. Longitudinal stability is weak to neutral at increasing aft center of gravity positions.

STICK FORCES

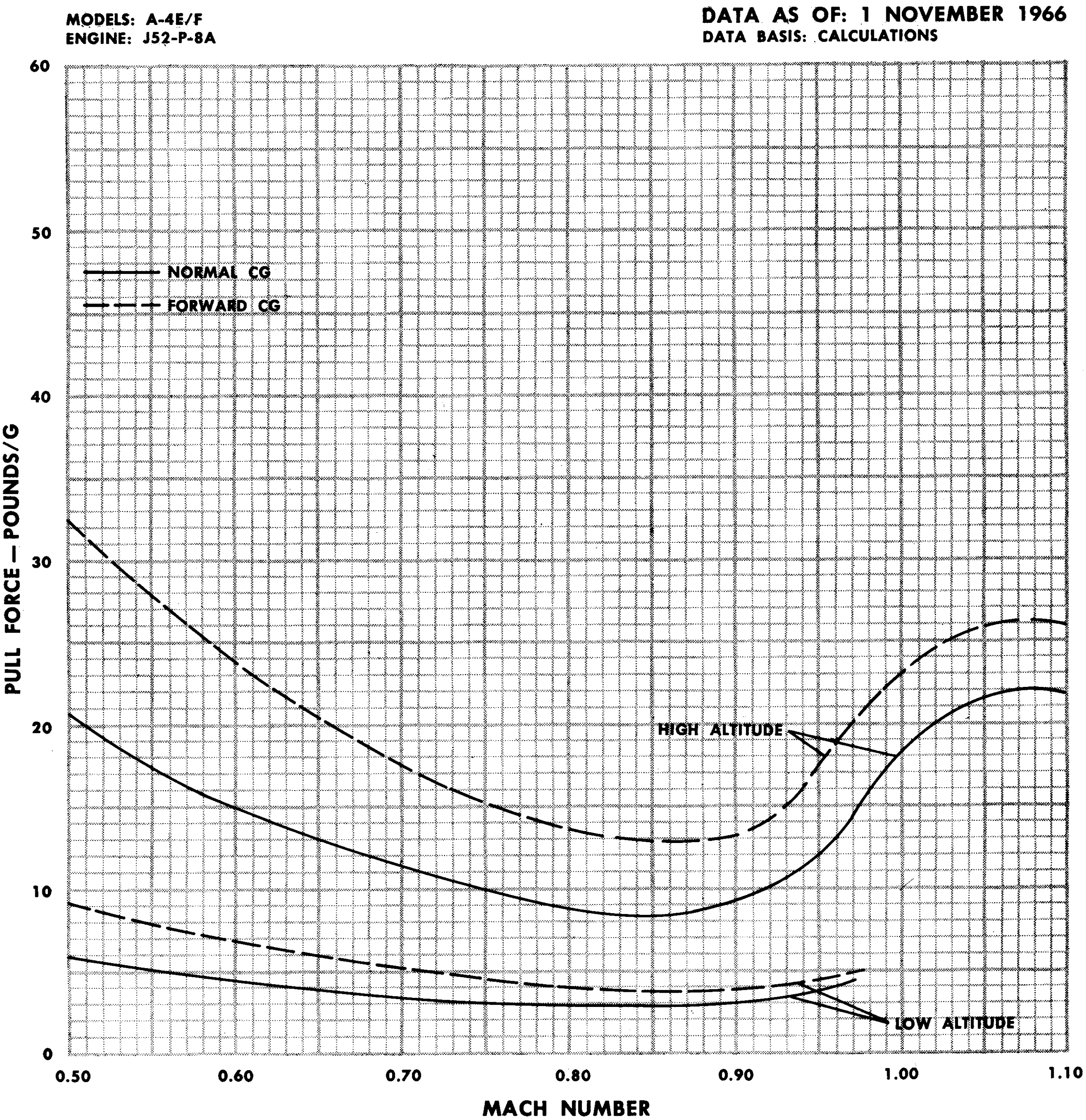


Figure 4-1. Stick Forces

TRANSONIC MACH CHARACTERISTICS

At airspeeds up to Mach 0.89 no unusual tendencies are exhibited and stick forces are low to moderate. A mild nosedown trim change occurs at Mach 0.89 and increases slightly up to Mach 0.98. The trim change can be counteracted by applying approximately one-half unit noseup stabilizer trim. (Refer to the paragraph on Diving, in this part. At Mach 1.02, a very light noseup tendency appears, and increases gradually up to the maximum permissible speed. Up to Mach number 0.90 the longitudinal stick forces are normal and control is good. Above Mach 0.90, the elevator effectiveness drops appreciably. Concurrent with this decrease is an increase in the stick force gradient (figure 4-1).

Transonic Pitchup

During recoveries from dives at supersonic speeds, a marked pitchup will occur at approximately 0.95 IMN. This increase in load factor is partially due to a marked increase in elevator effectiveness when decelerating through 0.95 IMN. After the initial abrupt increase in load factor or pitchup, the load factor will continue to build up at a slower rate as Mach number is decreased below 0.95 IMN, unless the pilot relaxes aft pressure on the stick.

In the critical aft cg condition, it is possible to develop the following load factors at supersonic speeds and maintain constant stick force as speed drops off to IMN = 0.85 without exceeding limit load factor in the ensuing pitchup:

10, 000 feet	3.8g
20, 000 feet	3.5g
30, 000 feet	3.2g

The pitchup severity depends on the initial load factor or stick position, being more severe for full aft stick. At altitudes above 15, 000 feet, and at high load factors, aircraft buffet will be encountered at above 0.98 to 0.95 IMN. This buffet should be heeded as a warning to relax aft stick pressure. If corrective action is applied by promptly relaxing the aft stick pressure, the pitchup can be appreciably lessened.

CAUTION

When using load factors in excess of those listed above for supersonic dive recoveries, relax aft stick pressure promptly, either upon encountering the initial sharp pitchup at about IMN = 0.95 or on encountering aircraft buffet. Note that at altitudes below 15, 000 feet aircraft buffet does not occur prior to pitchup.

Transonic pitchup during a speed reduction in the region where a marked increase in elevator effectiveness occurs can be appreciably decreased or eliminated entirely by reducing aft stick force as Mach reaches 0.98.

Flight With Power Control Disconnected

Power control disconnect above 300 KIAS or Mach 0.85 should be avoided if at all possible. Reduce thrust and open speedbrakes to decrease Mach to this value before disconnecting. Trim aircraft laterally prior to disconnect, if possible. The aircraft is subject to strong wing dropping tendencies above Mach 0.90, with the boost disconnected. Available rate of roll with maximum pilot effort in this speed range may be insufficient to overcome wing dropping tendencies. Although the aileron tab retains some effectiveness, the slow speed of operation of this tab makes it difficult to keep up with the random wing dropping. Wing dropping tendency disappears as airspeed is reduced to Mach 0.85, and available roll rate from pilot input forces increase, making the aircraft once more controllable. (Refer to Hydraulic Power Disconnect, section I, part 2.)

FLIGHT WITH EXTERNAL STORES

Flight characteristics with external stores aboard are satisfactory. Adequate control is available to hold the wings level during landing with an asymmetrical loading up to 7500 foot-pounds static moment on either wing. Wing heaviness or random wing drop may be encountered at medium altitudes (20, 000 to 25, 000 feet) and high subsonic speeds (between Mach 0.94 and Mach 1.0) when carrying certain stores, or in braked dives.

With various aft store loadings on the multiple bomb racks, the cg will shift aft. In the event that the aft bombs fail to release due to a rack malfunction, the cg may exceed the permissible aft limit. As the cg moves aft, the longitudinal stick forces become very light during low fuel state operation, and particularly in the landing configuration. If stick forces are so light and control sensitivity so great that landing may be extremely hazardous, the pilot should jettison the multiple bomb racks. (Refer to AN 01-1B-40, for permissible cg limits.)

With asymmetric loadings, simple elevator control displacement induces roll as well as pitch. With control hydraulic power on, aileron control is sufficient to counteract roll induced by elevator control displacement. With hydraulic power off, at speeds above 200 KIAS, the roll induced by elevator displacement cannot be adequately controlled because of high lateral stick forces and low lateral control response. Accordingly, with hydraulic power off, longitudinal control should be minimized and airspeed should not

exceed 200 KIAS with asymmetrical loadings. (Refer to Hydraulic Power Disconnect, section I, part 2.)

With asymmetric store loadings, the following recommendations are made:

1. A straight-in approach should be made when a known or suspected asymmetrical load is carried. Increased wing drop may be experienced if a break is made into the heavy wing. This condition greatly decreases available aileron deflection required for lateral attitude control, as the aircraft transitions from break airspeed to landing pattern airspeed.

2. That the minimum approach speed be 115 KIAS with up to 7500 foot-pounds of asymmetric moment, varying linearly thereafter to 130 KIAS at 12,500 foot-pounds. Normal approach angle of attack should be maintained so long as the resulting airspeed does not become less than this minimum. On manual control, with asymmetric moments up to 7500 foot-pounds, the initial approach speed should be a minimum of 140 KIAS, with a minimum final approach and touchdown speed of 125 KIAS. Landings on manual control with asymmetric moments greater than 7500 foot-pounds are not recommended. When landing with 7500 to 12,500 foot-pounds of asymmetric loading, a minimum rate of descent landing is recommended.

3. That crosswind landings be made upwind or downwind, whichever is required to put the crosswind component under the heavy or loaded wing providing other factors such as runway length and gross weight are considered.

MANEUVERING FLIGHT

Available maneuverability is shown graphically in figure 4-3. Longitudinal and lateral maneuvering characteristics are normal throughout the level flight speed range of the aircraft, however, flight characteristics in the following maneuvers should be noted.

Transonic Maneuvering

In the pullouts or maneuvering in the transonic range, a small abrupt random wing drop accompanied by general aircraft buffet occurs. The intensity of the buffeting is generally proportional to the load factor developed.

Aileron Rolls

During and upon termination of high rate aileron rolls (above 200 degrees per second) in the high speed, low altitude region, abrupt pitchdown will be noted. This pitchdown, though uncomfortable, is structurally safe and aircraft structure limits will not be exceeded provided that 360 degrees of roll are not exceeded.

CAUTION

When executing high rate, low altitude rolls (above 200 degrees per second), recovery controls must be applied after completing 180 degrees of roll to prevent exceeding 360 degrees of roll.

Rolling Pullouts

High sideslip angles and a pitchup tendency occur in rolling pullouts in which high roll rates are developed. At high altitudes, the pitchup tendency increases the likelihood of inadvertent stalling and spinning out of the maneuver. At low altitudes, sideslip angles are reduced but the pitchup tendency is considerably stronger. The normal load factor should be monitored during rapid rolling pullouts at low altitude, and if an increase in the normal load factor is noted, the stick should be eased forward.

Rolling Pushovers

During recoveries from high rate rolling pushovers in the high and medium speed, low altitude region, a marked pitchdown will be noted. The pitching tendency is a result of inertia coupling and is not noticeable in normal rolling pushovers with a moderate roll rate. If bank angle changes are limited to 180 degrees or less, the pitchdown will not become excessive regardless of the lateral stick deflection used during the maneuver. In a stabilized dive of 45-degree dive angle, or greater, the decreased normal load factor results in the same effect as a pushover and the recovery from high rate rolls in the above regions will also cause a pitchdown.

CAUTION

The pitchdown, described above, may exceed the structural limits of the aircraft.

High Angle-of-Attack Pitchup

During flight with center of gravity aft of 26 percent MAC, high angle-of-attack pitchup may be encountered when applying load factor. This pitchup is normally preceded by buffet onset and a buildup of buffet intensity. The pitchup manifests itself by a rapid increase in load factor with no change in stick position. At altitudes above 30,000 feet, the aircraft limit load factor will not be exceeded if pitchup is encountered. At altitudes below 15,000 feet and speeds above Mach 0.80, limit load factor precludes the aircraft from encountering pitchup. Between 0.50 and 0.80 Mach with a center of gravity of 26 percent, it is

possible to attain pitchup when maneuvering near limit load factor. At altitudes of 15,000 to 30,000 feet, the pitchup can cause the limit load factor to be exceeded. Even though the elevator effectiveness is drastically reduced under these conditions, the severity of the pitchup can be controlled by partial forward stick movement. Buffet onset and ensuing buildup in intensity serve as a warning that the pitchup boundary is being approached.

Pitchup does not occur below Mach 0.40 and therefore does not present a landing or low speed problem. It can be avoided entirely by limiting pullups to buffet onset when flying with less than 750 pounds of fuel aboard or with other loadings where the cg is aft of 26 percent MAC. (Refer to cg loading charts.)

CAUTION

Full forward stick should not be used to recover from a high angle-of-attack pitchup, as excessive negative load factors will occur.

STALLS

Stall characteristics are normal in all configurations. The conventional technique of decreasing angle-of-attack with forward stick, simultaneously adding of full power, then leveling the wing should be used to recover from a stalled condition. An angle-of-attack setting of between 8 and 12 units is recommended for recovery from nose-high stalls. Warning of an impending stall occurs in the form of light buffeting of the aircraft, increasing in intensity as the stall is approached. The characteristics of a stall are a mild nosedown pitching accompanied by light directional and lateral oscillation. If the stall is reached when a high power setting is used, the nosedown pitch is very mild. Any tendency for a wing to drop can be effectively counteracted by application of opposite rudder. Stall speeds are shown in figure 4-2.

NOTE

Asymmetric slat extension may require full lateral control to maintain wings level when airspeed is approximately 5 knots above stall.

Accelerated Stalls

Accelerated stalls are preceded by adequate stall warnings in the form of general airframe buffeting.

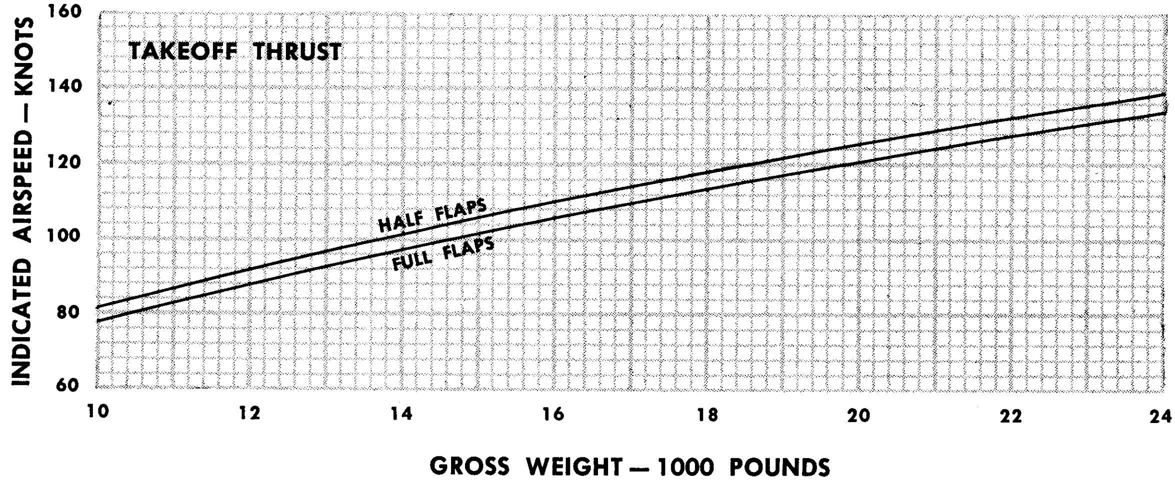
Recovery is easily accomplished by employing conventional technique. A light buffet occurs just prior to slat opening. After the slats open, the buffeting disappears until the airspeed decreases to the accelerated stall warning speed, at which time the buffeting occurs again. Occasionaly, failure of the slats to open simultaneously causes an abrupt roll toward the side with the slower opening slat. When aggravated by an aft center of gravity position and by asymmetric slat extension, an accelerated stall may result in an uncontrollable roll, which will stop when the load factor is reduced.

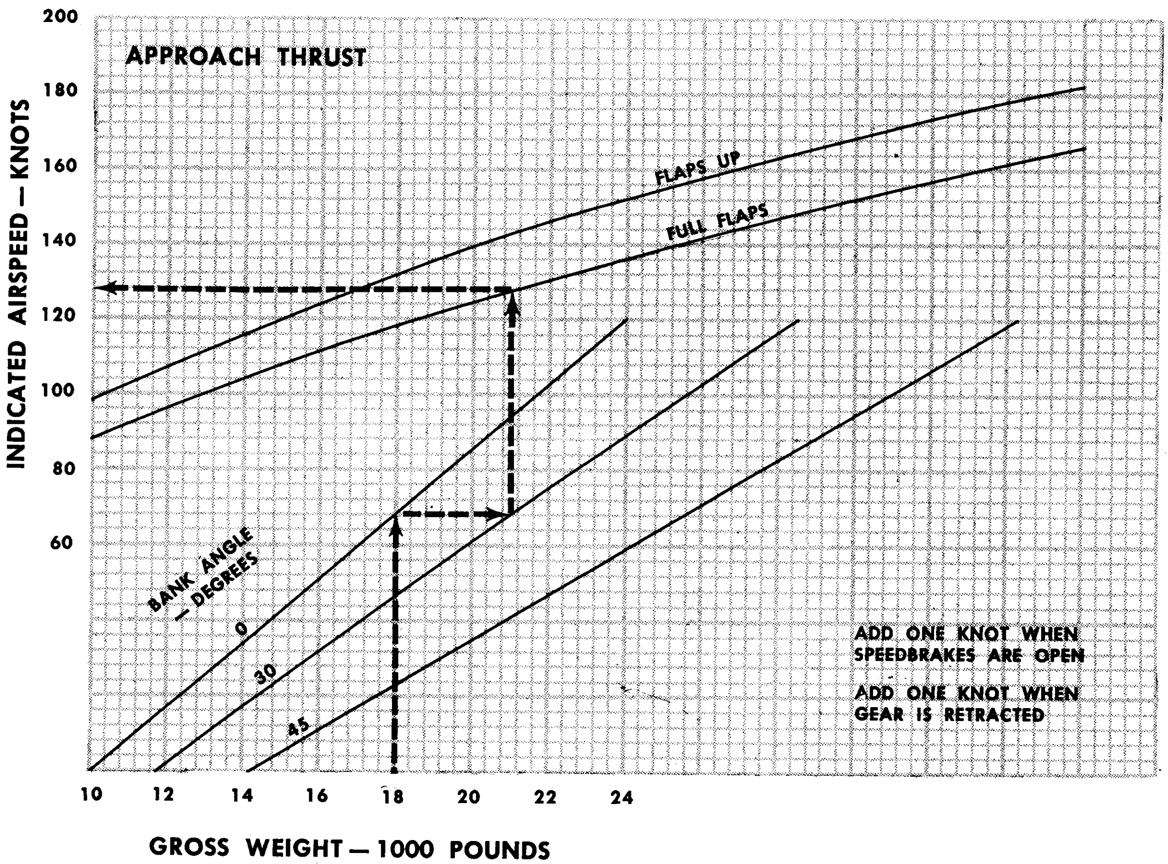
STALL SPEED

SPEEDBRAKES RETRACTED
GEAR DOWN

MODELS: A-4E/F
ENGINES: J52-P-6A/8A

DATA AS OF: 1 NOVEMBER 1966
DATA BASIS: ESTIMATED





GG1-23

Figure 4-2. Stall Speeds

SPIN CHARACTERISTICS

Flight tests and spin tunnel model tests indicate spin recovery is possible in all configurations. The aircraft proved reluctant to enter a fully developed spin unless pro spin control is applied and maintained. Erect spins resulted from noseup elevator control and inverted spins from nosedown elevator control.

The aircraft oscillates about all axes in a spin, with erect spins being the most oscillatory. A 360-degree roll occurs during the first one to three turns of an erect spin. Bank oscillations decrease to about 60 degrees after the third turn of an erect spin. The aircraft pitches from near level to a 70-degree nosedown attitude during each turn. There is a hesitation in spin rotation at the completion of each turn in the spin. Spin rotation varies from 5 to 10 seconds per turn with an altitude loss of 3000 to 5000 feet per turn. Faster spin rotation rates result in lower altitude loss per turn. Slower spin rotation rates result in greater altitude loss per turn. Rate of descent will vary from 30,000 to 36,000 feet per minute, depending on the steepness and rotation rate of the particular spin. Load factors of 1.0 to 3.5g have been experienced during the spin.

Erect spins entered from an accelerated stall have the same characteristics as 1.0g-spin entries except that snap-roll type maneuvers occur during the first two or three turns. Erect spin characteristics with external stores are the same as the clean aircraft except that the oscillations occur at a lower frequency.

Relatively flat, erect spins have developed after several steep turns such as described above. There is no hesitation in spin rotation and the rate is very fast: 3 seconds per turn with an altitude loss of 1500 to 2000 feet per turn. Rate of descent will vary from 30,000 to 40,000 feet per minute. Aircraft pitch oscillations vary from 25 to 50 degrees nosedown and oscillations vary between 20 degrees left and right wing down.

Inverted spin characteristics with or without external stores are the same. The aircraft abruptly whips into an inverted spin when the necessary conditions are established: forward elevator control developing a negative load factor while the aircraft is simultaneously yawing and rolling to an inverted attitude. A fully developed inverted spin occurs within one turn. The spin is relatively flat at a fast rate: 3 seconds per turn with an altitude loss of 800 to 1500 feet per turn. Rate of descent will vary from 16,000 to 30,000 feet per minute. Aircraft pitch oscillations vary between 20 to 50 degrees nosedown while bank oscillations vary between 30 degrees left and right wing down about an inverted attitude. Negative load factors of 0.5 to 1.0g have been experienced during an inverted spin.

WARNING

If an inadvertent confirmed spin occurs below 10,000 feet AGL, eject. Recovery from a fully developed spin below 10,000 feet is considered doubtful since 5000 to 7000 feet are required to complete recovery with proper application of the controls. Recovery from an inadvertent incipient spin may be accomplished with altitude losses varying from 0 to 7000 feet, depending upon how fully developed the spin becomes.

Spin Recovery

Experience has shown that neutralization of all flight controls will facilitate recovery during the incipient phase (uncontrolled flight immediately after a fully developed stall). Application of spin recovery controls during the incipient phase greatly increases the probability of spin entry. Therefore, the first step in any spin recovery is to make certain that the aircraft is actually in a spin.

The large pitch and roll attitude changes combined with high yaw rates make it difficult for the pilot to determine from the outside view whether the aircraft is spinning erect or inverted. The most positive spin direction and type of spin indicators are the turn needle and angle of attack. The turn needle always indicates the direction of rotation. The angle of attack indicates whether the spin is erect or inverted: 0-units angle of attack for inverted spin; 30-units angle of attack for erect spin.

External stores do not affect the recovery procedure from an erect or inverted spin. Considerable angular momentum is developed during a spin. Recovery control application may be required to be held for up to two turns during the faster flat erect spins.

The control should be held full in the recovery position until the spin rotation has stopped. Recovery from even the most adverse spin has occurred within two turns after proper recovery control was applied and maintained.

Erect Spin

The recovery technique from an erect spin is brisk application of full rudder pedal deflection against the spin (opposite direction of the turn needle) followed by neutral application of elevator and aileron control stick deflections. If spin rotation does not stop within 2 turns, a flat spin has developed. Brisk application of full aileron control stick deflection with the spin (same direction as the turn needle) and full aft elevator control stick deflection must be applied, while maintaining full opposite rudder pedal deflection against the spin, to stop the spin rotation. Neutralize all controls when spin rotation stops. The aircraft will be in a nosedown attitude and a diving pullout should be made to build up airspeed to accomplish complete recovery from the spin. An altitude loss of 4000 to 5000 feet will occur in the recovery.

Inverted Spin

The recovery technique from an inverted spin is brisk application of full aileron control stick deflection against the spin (opposite direction of the turn needle) with simultaneous application of full rudder pedal deflection against the spin (same direction as aileron). Elevator control stick position is not critical in an inverted spin; therefore, a neutral position is recommended. The ailerons are the primary recovery control and aircraft response will occur in the form of roll in the direction of the applied aileron. Spin rotation abruptly stops as the aircraft rolls around to an erect nosedown attitude. Neutralize all controls when it is recognized that spin rotation has stopped and make a diving pullout to build up airspeed to accomplish complete recovery. A loss of altitude of 5000 to 7000 feet will occur in the recovery.

Stabilizer Trim

Stabilizer trim setting will not delay stopping the yaw and rotation rate of the spin. However, noseup trim settings greater than approximately 9 degrees may cause the aircraft to enter an accelerated stall during dive pullout, subsequent to spin recovery. A stabilizer trim range of 0 to 4 degrees aircraft noseup is recommended. Do not delay applying spin recovery controls to retrim aircraft.

Dive Recovery

Following spin recovery, airspeed will increase rapidly because of the aircraft nose-low attitude. Altitude loss can be minimized by use of the angle-of-attack indicator. Smooth noseup elevator should be applied as the airspeed increases through approximately 250 knots to attain and maintain 20 units angle of attack with power added as required to maintain 250 knots throughout the recovery. This will provide for minimum altitude loss with the minimum stall margin. Twenty units angle of attack is difficult to fly without overshooting. Seventeen units or lower angle of attack is easier to fly and should be used when terrain clearance is not critical.

Available Maneuverability

For available maneuverability of the A-4E/F, refer to figure 4-3.

Diving

The diving characteristics of the aircraft are normal except when steep clean dives are conducted from high altitudes where airspeeds increase into the supersonic range. Under these conditions, the elevator effectiveness will be reduced and the aircraft basic stability will become high, and it will be necessary to retrim with the stabilizer to dive the aircraft supersonically.

Dive recovery nomographs are provided on figure 4-5. Figure 4-5, sheet 1 shows the altitude loss after the load factor is applied and sheet 2 shows the pilot reaction time. An additional factor, altimeter lag, must be added to the above two values to determine the total loss in altitude from initiation of the dive recovery to level flight.

WARNING

Figure 4-5 (sheets 1 and 2) does not consider buffet onset or strucutral limits. (See figures 11-43 and 11-82.)

AVAILABLE MANEUVERABILITY

GROSS WEIGHT = 13,826 POUNDS
CG @ 20.9% MAC

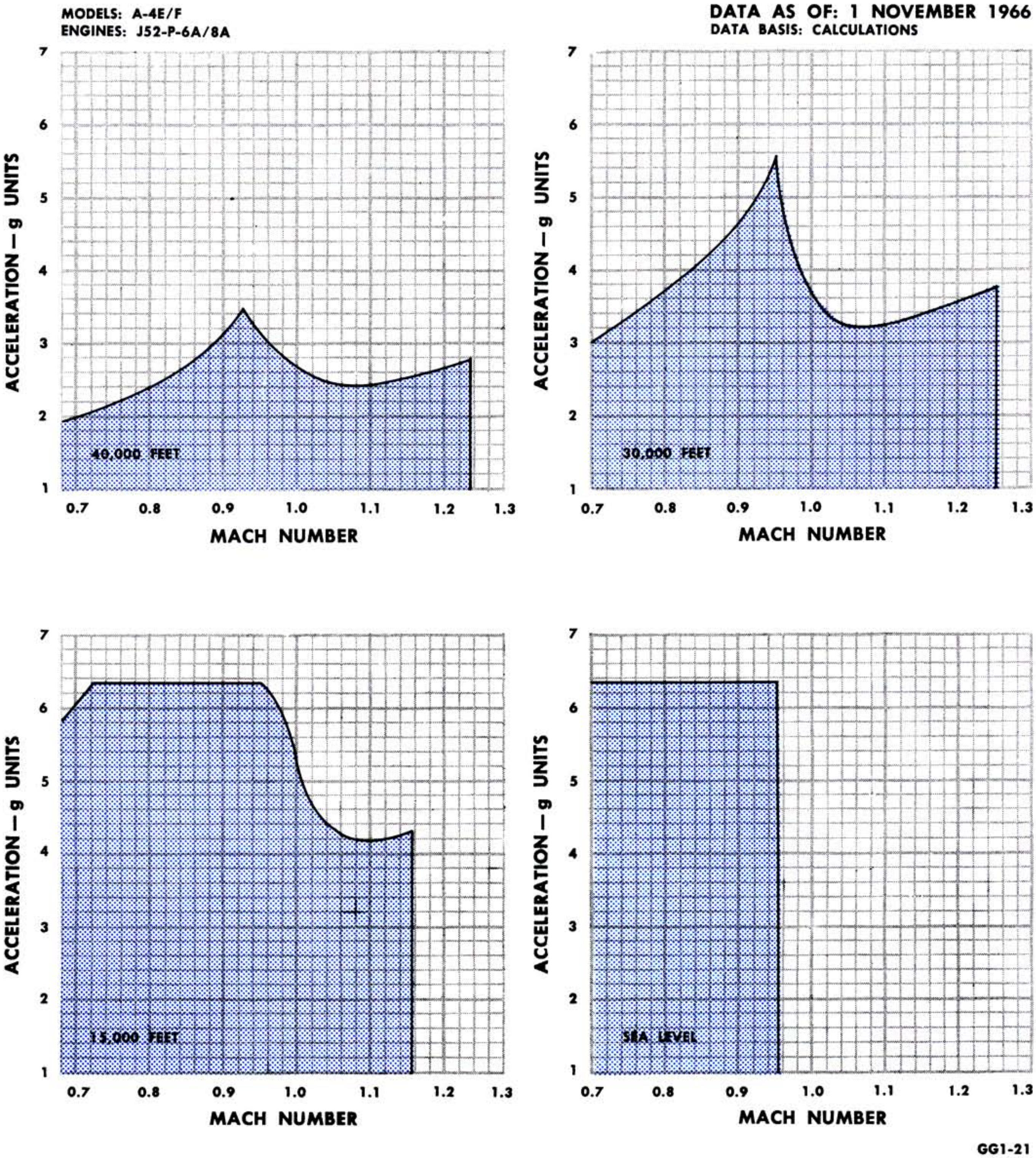


Figure 4-3. Available Maneuverability

TYPE OF SPIN	RUDDER	AILERON	STICK
ERECT	FULL - OPPOSITE TO TURN NEEDLE	NEUTRAL	NEUTRAL
	If no response:		
	FULL - OPPOSITE TO TURN NEEDLE	FULL - WITH TURN NEEDLE	FULL AFT
INVERTED	FULL - OPPOSITE TO TURN NEEDLE	FULL - OPPOSITE TO TURN NEEDLE	NEUTRAL

Figure 4-4. A-4E/F Spin Recovery

The accelerometer should be referred to immediately upon initiating a pullout from a supersonic dive to ensure that enough load factor is being developed to recover.

NOTE

- If difficulty is experienced in recovering from dive, speedbrakes should be opened immediately and throttle retarded in an effort to reduce airspeed and limit altitude loss in recovery maneuver.
- Maximum speed for fully effective opening of speedbrakes is 440 KIAS. However, speedbrakes are partially effective up to maximum speed capabilities of the aircraft.

If the elevator power system should fail during a supersonic dive, the stick force required for recovery will be so high as to prohibit normal recovery procedures. Use of aircraft noseup stabilizer trim will then become mandatory to effect recovery.

CAUTION

Do not use the horizontal stabilizer as a dive recovery device except in an emergency, as a strong pitchup will result as the airspeed drops below approximately Mach 0.94.

Trim settings for diving should be established on the basis of aircraft configuration and a knowledge of the individual aircraft, as each will require somewhat different trim settings for a given flight condition. It is usually considered preferable to trim the aircraft so that a moderate push force is required to maintain the dive just prior to the pullout.

If the speedbrakes are used before entering the dive, airspeeds will be limited to lower values where the increase in stick forces will not be severe.

NOTE

The speedbrakes will begin to "blowback" at approximately 490 KIAS.

The speedbrakes should not be closed until the recovery has been completed to prevent an increase in stick forces resulting from the combined effects of the buildup in airspeed and the characteristic nose-down trim changes that accompanies closing of the speedbrakes. The control stick forces required to produce 1g change in load factor at various Mach numbers are presented in figure 4-1.

FLIGHT CHARACTERISTICS ON AFCS

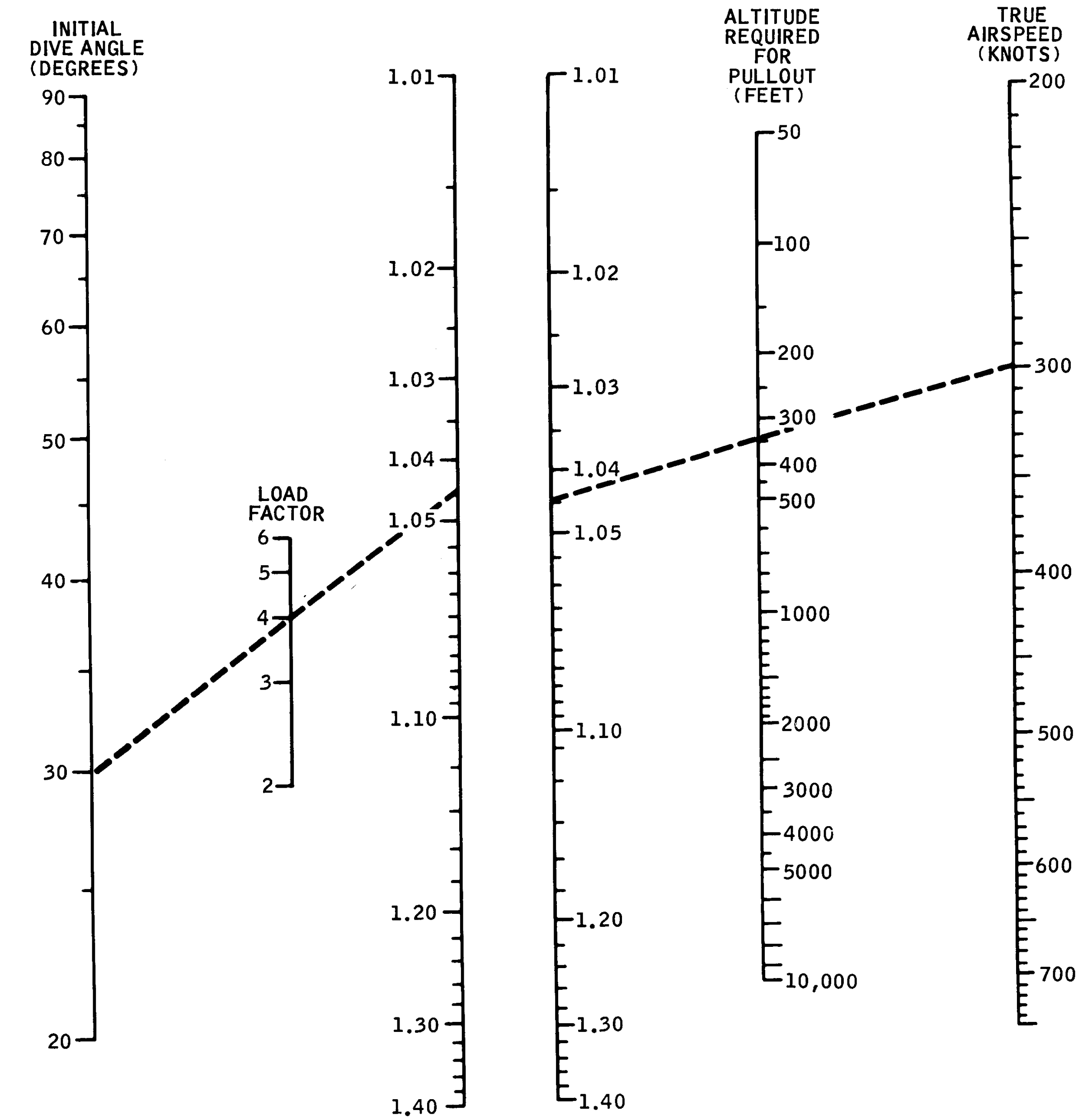
The AFCS (autopilot) is described in detail in section I, part 2. When flying "hands off," the aircraft is completely stable about all three axes, with no tendency to oscillate. Refer to section I, part 4 for Airspeed Limitations while operating on AFCS.

Certain flight characteristics of the AFCS are inherent in its detail design and constitute normal performance. Flight characteristics which are evident to the pilot are discussed in the following paragraphs.

Wing Down Phenomena on Heading Hold

There are particular circumstances which may result in temporary wing down condition while on heading hold. Asymmetric loading, directional trim, and platform gyro precession result in temporary wing down conditions.

DIVE RECOVERY
ALTITUDE LOSS DURING CONSTANT G PULLOUT



NOTE:

$$\Delta h = 0.08856\, V_T^{\,2} \ln\left(\frac{n - \cos\gamma}{n - 1}\right)$$

Δh = ALTITUDE LOST (FT)

V_T = TRUE AIRSPEED (KN)

n = NORMAL LOAD FACTOR

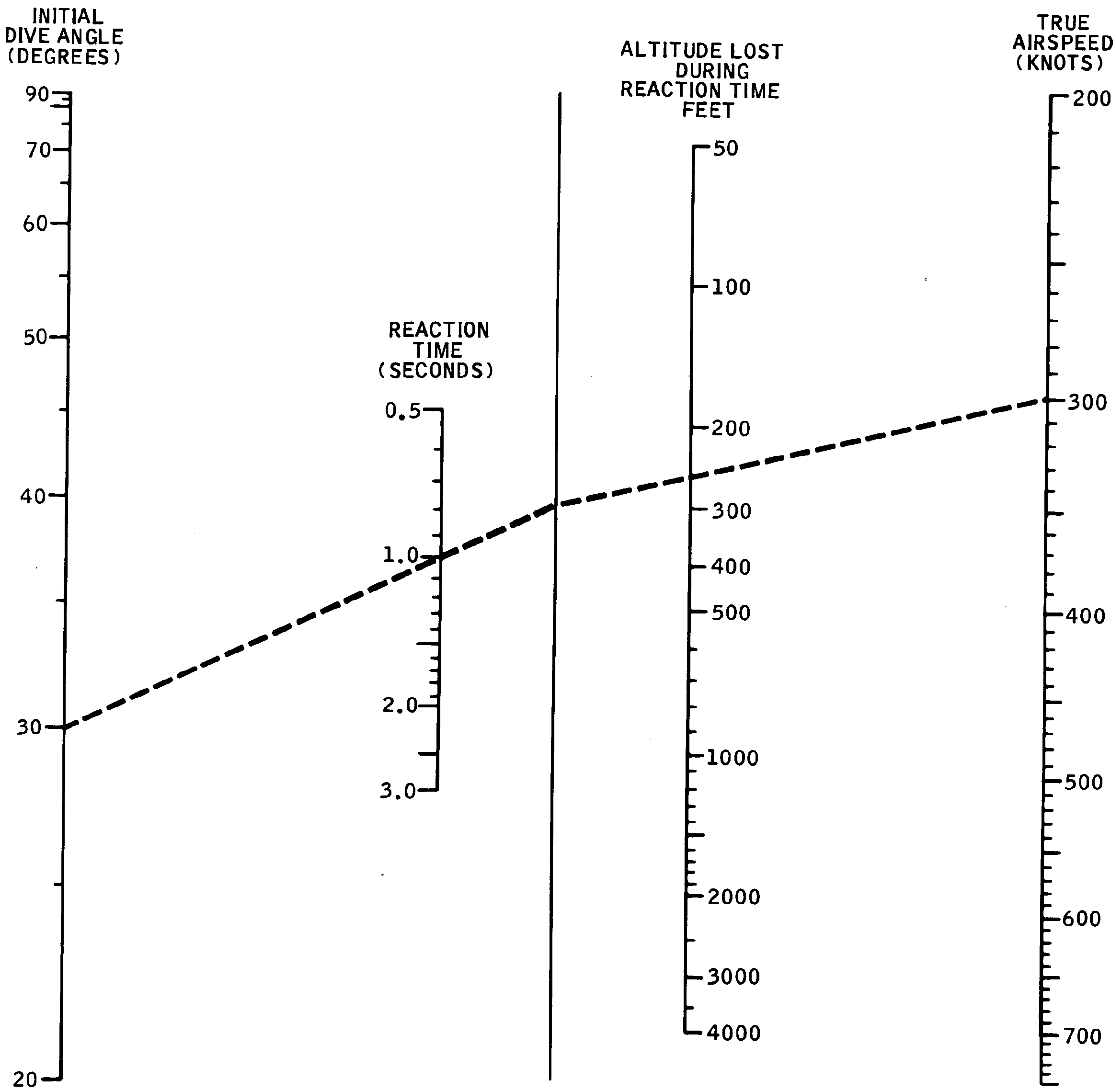
γ = FLIGHT PATH ANGLE

HH1-95

Figure 4-5. Dive Recovery Chart (Sheet 1)

DIVE RECOVERY

ALTITUDE LOSS DURING PILOT REACTION TIME



NOTE:

$\Delta h = 1.689\ V_T \times \Delta T \sin \gamma$

Δh = ALTITUDE LOST (FT)

V_T = TRUE AIRSPEED (KN)

ΔT = REACTION TIME (SEC.)

γ = FLIGHT PATH ANGLE (DEG.)

HH1-96

Figure 4-5. Dive Recovery Chart (Sheet 2)

Asymmetric loading causes the aircraft to be directionally out of trim and to fly wing down. Lateral and directional trim is available to the pilot and he should trim when necessary. On AFCS, directional trim is available at all times. Lateral and pitch trim is available in the control stick steering mode. If the pilot does not trim directionally, the aircraft will maintain a constant skid at a banked attitude. Speed changes result in changes in directional trim. On AFCS flight, just as in normal flight, the pilot should trim the aircraft as necessary.

ROLLBACK ON ROLL ATTITUDE HOLD

Control stick steering switching levels and pilot technique in conjunction with the ability of the AFCS to synchronize changes in roll attitude will determine the amount of rollback obtained on roll attitude hold. On establishing a bank angle, some pilots prefer to release the stick before the rolling rate decays to zero. In this event, the roll synchronizer will lock on the roll reference at the time the force on the stick passes below 2 pounds. The aircraft overshoot and "rollback" can be as much as 5 degrees to the AFCS reference. If the pilot elects to hold the desired bank angle in control stick steering for a second or two, no rollback will occur. Both techniques may be used. Obtaining roll attitude accuracy will require use of the latter technique.

Control Stick Steering Feel

The flight characteristics when on "control stick steering" mode are the same as for the basic aircraft except that the control stick experiences a change in feel which is the result of roll rate feedback and mode switching.

When on control stick steering, the stick is referenced to the rate gyros and as rate is developed, a very small amplitude, low frequency stick motion or feel results. Slight stick transients caused by the automatic return to the heading hold mode occur when making small bank or heading changes. These transients will be observed whenever the stick force varies above or below the 2-pound level and the aircraft is at a bank angle of less than 5 degrees. Such transients are normal and result from the design characteristics of the heading hold mode.

PITCH

On control stick steering mode, forces are provided by electrical signals from the accelerometer, pitch rate gyro, and elevator deflection. The resulting electrical "feel" is slightly lower than that of the normal power control. There is less variation in stick force per "g" over the flight regime. The breakout force on control stick steering mode has been reduced to 2 pounds, as compared with 3 pounds on normal power control.

ROLL

Aileron control forces in the control stick steering mode are slightly lower than normal power control forces. Breakout forces are 2 pounds and 3 pounds, respectively.

YAW

The rudder control forces and breakout forces are identical in both modes.

Control Stick Steering Engage Transients During Auto Trim

The AFCS is equipped with automatic pitch trim which operates within 4 to 6 seconds after establishing a new flight condition. If the pilot should elect to go back on control stick steering before the automatic trim system has stabilized, he may encounter a control stick steering engage transient. This is normal and will not occur if the pilot remains out of the CSS mode longer than 6 seconds.

Hesitation or Loss of Rolling Rate on Preselect Heading Roll In.

During the preselect heading roll in, a slight hesitation or loss of rolling rate may occur at approximately 20 degrees of banked attitude. This is a normal phenomenon which is not detrimental to the performance of these circuits.

Preselect Heading "Steppy" Rollout

During the preselect heading rollout a tendency to roll out in steps or hesitations has been observed. These steps are the result of choosing the optimum gain ratio between heading and roll attitude. The optimum heading to bank ratio is a compromise between a smooth rollout and a short rollout time.

Sensitive Regions of Preselect Heading

Abrupt roll transients will occur on preselect heading if the SET knob is adjusted to command a turn in a direction opposite to the turn being made. The same phenomenon will occur if a heading change greater than 180 degrees to the present aircraft heading is commanded while the aircraft is stabilized in the preselect heading turn. The preselect heading mode is

designed to take the shortest path to the selected heading. If the aircraft is stabilized in a bank for a left turn and a right turn is commanded, the aircraft will immediately roll the opposite direction at maximum rate. Such preselect heading commands should not be initiated while stabilized in a turn.

Longitudinal Stick Motion During Automatic Trim

Automatic trim or trim transfer is provided when the pilot relief modes of the AFCS are in use. When the automatic trimming occurs, the stick is observed to move longitudinally. This movement arises from two sources. These are the geared elevator effect and relief of trim. The elevator is mechanically geared to the stabilizer so that any motion of the stabilizer will result in a motion of the elevator. The elevator motion is always in a direction to increase the camber of the horizontal tail. Trim relief occurs when the elevator is no longer holding the aircraft in trim and the elevator is returned to the zero position. The stabilizer now maintains aircraft trim. In event of a maneuver such as prolonged high "g" turns in attitude hold, automatic trim of the horizontal stabilizer will result in 2 to 3 degrees noseup stabilizer. As speed decreases additional noseup stabilizer is required. At this time, if reversion to level attitude hold is desired, a force up to 15 pounds may be required on the stick, and if released, will cause pitchup. This stick force must be trimmed out on AFCS to approximately zero force prior to releasing stick.

APPROACH POWER COMPENSATOR

Normal Procedures

BEFORE LANDING

Perform the following checks and actions:

1. Complete landing checklist.

2. Throttle friction - OFF.

3. Air temperature switch - SET.

4. APC power switch - STANDBY (observe APC light ON).

5. APC power switch - ENGAGE (observe APC light OFF).

WARNING

Do not engage APC with the fuel control in MANUAL. Automatic throttle movements associated with APC operation are rapid and could result in compressor stall or flameout.

6. Throttle - observe movement.

7. Angle of attack/airspeed - Cross-check.

AFTER LANDING

Perform the following checks and actions:

1. Throttle - position as required.

2. APC light - ON.

3. APC power switch - check for STANDBY position.

APC Technique

The technique required for an APC approach differs from a manual approach in that all glideslope corrections are made by changing aircraft attitude. Since this technique violates the basic rule that altitude is primarily controlled by the throttle, practice is required to develop the proper control habits and coordination necessary to use APC.

Smooth attitude control is essential for the satisfactory performance of the APC. Large, abrupt attitude changes result in excessive thrust changes. Close-in corrections are very critical. A large attitude correction for a high close-in condition produces an excessive power reduction and can easily result in a hard landing. If a high close-in situation develops, the recommended procedure is to stop meatball movement and not attempt to recenter the meatball. A low close-in condition is very difficult to safely correct with APC and usually results in an over-the-top bolter. The recommended procedure for a low close-in condition is to override the APC and complete the pass manually. Throughout the approach, the pilot should keep his hand lightly on the throttle in case it becomes necessary to manually override the APC.

ANGLE-OF-ATTACK RELATIONSHIP

The angle-of-attack relationship for the operational envelope of the aircraft is portrayed in figure 4-6.

ANGLE-OF-ATTACK RELATIONSHIP

SPEEDBRAKES CLOSED

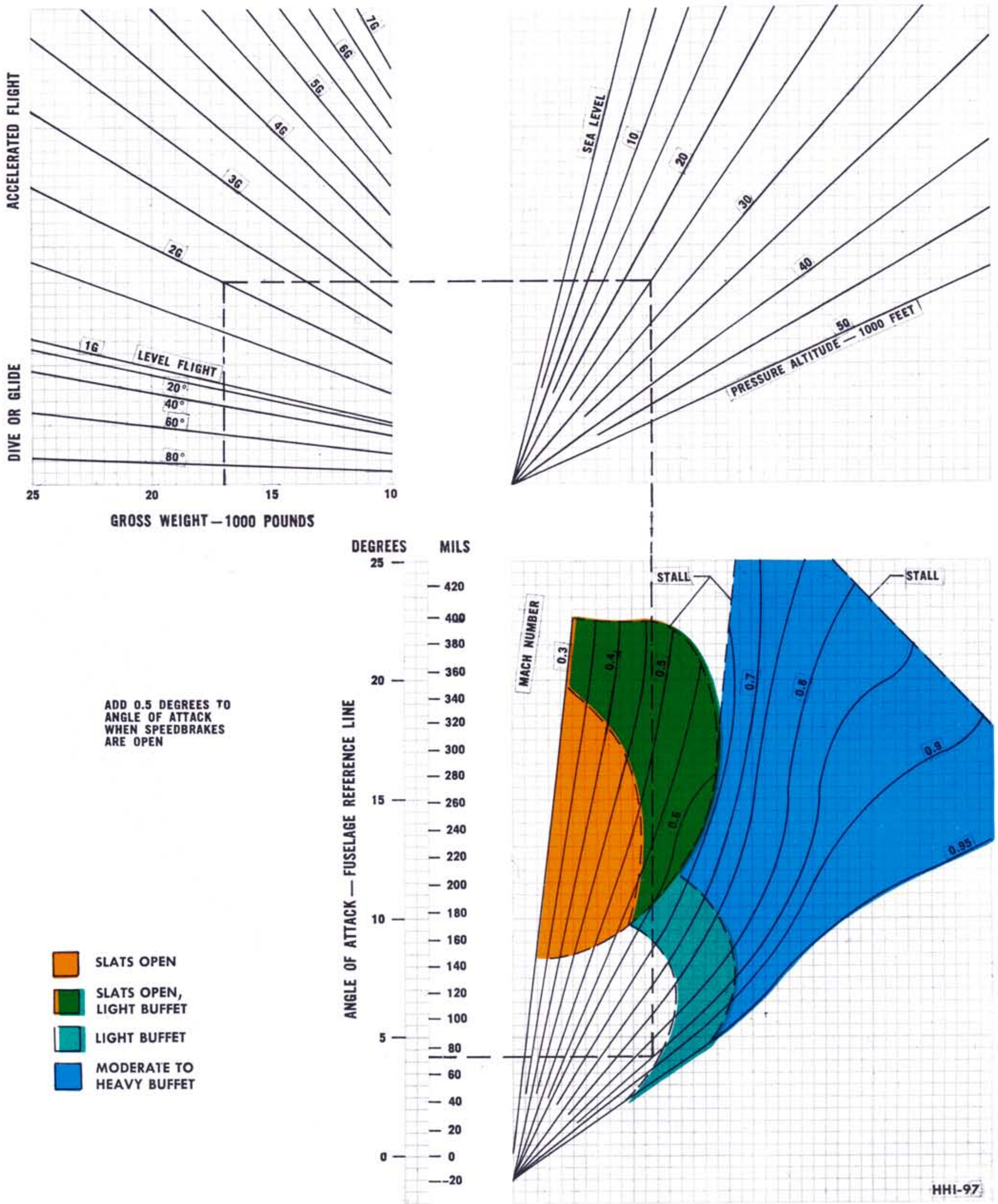


Figure 4-6. Angle-of-Attack Relationship (Sheet 1)

ANGLE-OF-ATTACK RELATIONSHIP
SPEEDBRAKES CLOSED

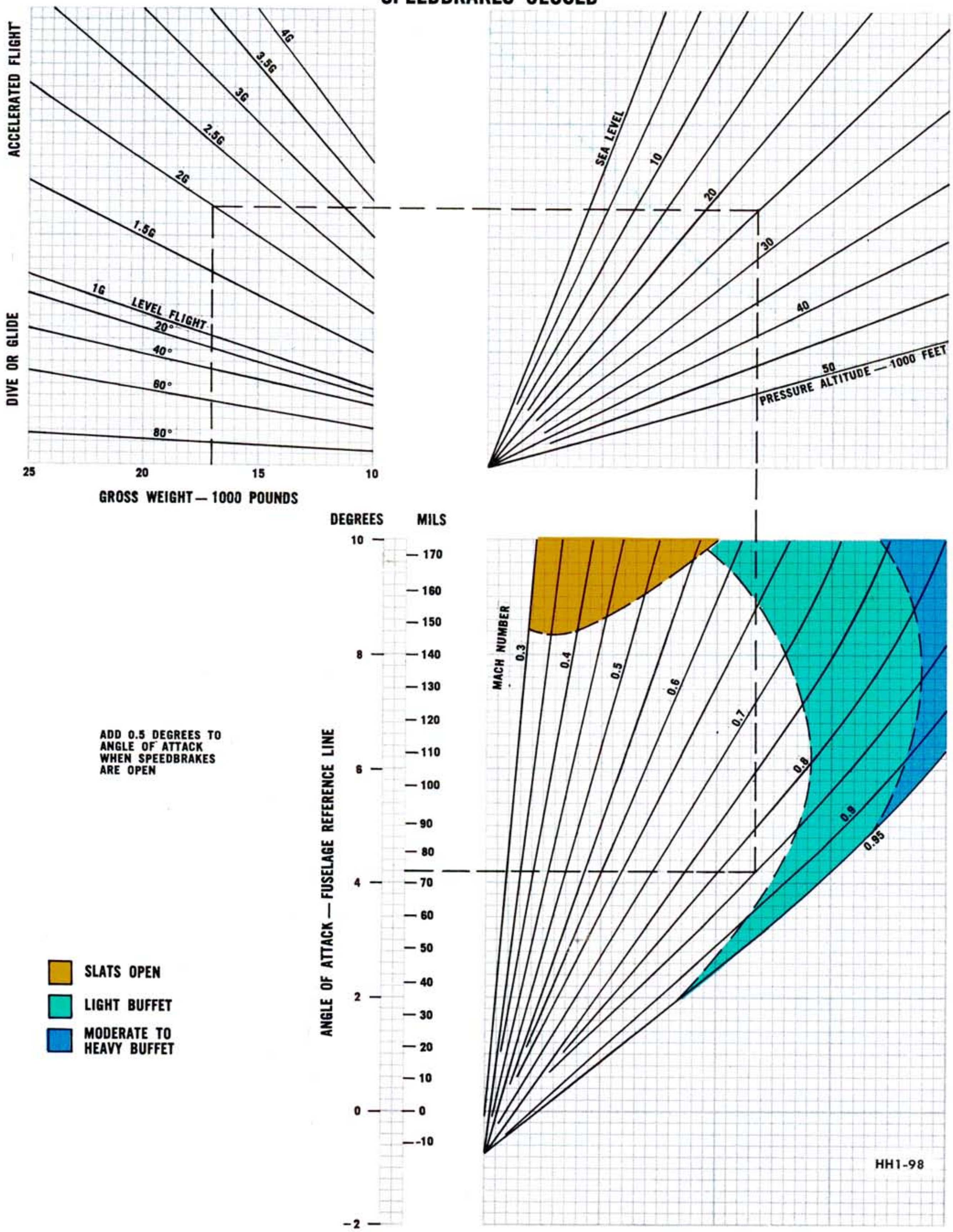


Figure 4-6. Angle-of-Attack Relationship (Sheet 2)

PART 2
FLIGHT PROCEDURES

FLIGHT PROCEDURES

General

The basic flight procedures contained in this section are for guidance. Where amplification is desired, refer to the appropriate Naval Warfare Publication.

TRANSITION AND FAMILIARIZATION

Requirements

Transition and familiarization will be accomplished in accordance with the requirements outlined in section II. This training will be conducted in the replacement air wing or in the squadron, as directed by the appropriate Commander. It is desirable that pilots with no recent jet experience demonstrate their proficiency in two-seated, swept-wing jet trainers prior to flying the A-4 aircraft.

Familiarization flights should be designed to acquaint the pilot with the flight characteristics of the A-4E/F while it is flown at various attitudes, altitudes, and configurations.

Procedures

The following procedures shall be followed for the first familiarization flight, in addition to those required for other flights.

BEFORE FLIGHT

The chase pilot shall accompany the familiarization (Fam) pilot during his preflight inspection and start. The Fam pilot shall be the lead aircraft on the takeoff.

DURING FLIGHT

Perform those prebriefed maneuvers which will give a general feel of the aircraft, both in the clean and dirty configuration. Stalls and confidence maneuvers will be practiced in designated areas and at altitudes which will ensure straight and level flight above 10,000 feet AGL upon completion.

RETURN TO FIELD AND LANDINGS

The Fam pilot will lead the flight back to the field. Landings on the first two Fam flights will be monitored by a chase pilot, or by a qualified A-4E/F pilot at the end of the runway with radio communications. If the approaches are chased, the chase pilot will fly a comfortable yet reasonably close wing position on the Fam pilot throughout all landings and will coach the Fam pilot when necessary. Chase aircraft will not descend below 100 feet, and should follow the configuration changes of the Fam pilot during the approach.

Weather Considerations

All familiarization flights will be conducted under conditions which will permit climb and descent in VFR conditions and permit visual contact with the ground at all times.

NORMAL FLIGHT

Cruise Control

For general cruise-control techniques refer to A-4/TA-4 Tactical Manual, NAVAIR 01-40AV-1T. Cruise-control data for the A-4E/F is contained in section XI of this manual. Additional comments and suggestions follow.

CLIMB

Acceleration to initial climb speed should be effected prior to passing through 1000 feet.

Use the airspeeds recommended in the Performance Data charts to obtain the best rate of climb; however, speeds may be varied 10 knots above or below those stipulated without appreciably affecting climb performance. Maintain MILITARY rpm throughout the climb for best results, observing at all times the engine rpm, exhaust gas temperature, and time limitations as set forth in section XI.

CRUISE

Shortly after leveling at altitude and establishing cruising speed, the pilot should note the fuel used in the climb and check actual fuel flow against the planned consumption rate. The transfer from the external tanks should be commenced. Each pilot should develop his ability to judge distances on the ground from his position and altitude. This sense of distance is quite necessary for accurate navigation at high altitude. Landmarks at considerable distances from the desired track may frequently be used.

DESCENT

Descents may be made very rapidly by using IDLE power and speedbrakes.

For a maximum range descent, throttle back to IDLE and maintain the gliding speeds recommended in section XI.

CAUTION

> Maintain gliding speed. Do not select power settings below 65 percent RPM when below 225 knots.

Prior to descent, adjust cabin temperature and defrost air as necessary to prevent windshield frost.

FORMATION AND TACTICS

Procedures for specific maneuvers are promulgated in the A-4/TA-4 Tactical Manual, NAVAIR 01-40AV-1T. The following instructions apply to A-4/TA-4 aircraft as general basic maneuvers.

Rendezvous

TURNING RENDEZVOUS

The turning rendezvous is made at 250 KIAS (unless otherwise briefed). When all aircraft are in a loose trail position, the leader commences a 25- to 30-degree bank turn. Each member of the flight waits until the lead aircraft passes 30 degrees off his nose (out of the bullet resistant windshield) and then rolls into a 45-degree bank turn, moving toward the inside of the leaders turn. After the leader passes back through the 12 o'clock position, the bank angle should be decreased slightly to avoid an excessive heading change. Wingmen may add enough power to gain a 10- to 15-knot speed advantage to expedite the rendezvous. As the rendezvous bearing is attained (35 to 40 degrees aft of abeam), adjust the bank angle to maintain this bearing. As the aircraft closes on the leader and his aircraft becomes more well defined, the leading edge of his wing (38 degrees) should be utilized as the correct bearing, and power should be readjusted to control the closure rate. The wingman should join on the inside of the leader and then cross-under to a normal wing position on the opposite side. This rendezvous may be accomplished either in level flight or with the leader in a stabilized climb.

TACAN-CIRCLING RENDEZVOUS

A TACAN-circling rendezvous is used when aircraft are separated by extended or indefinite distances or time intervals. The pattern will be a port orbit tangent to the designated TACAN radial, at a specified distance and altitude. Normally, each pilot flies outbound on the assigned radial, maintaining the briefed climb schedule and cruise speed. Upon reaching the joinup circle, each pilot commences a 250 KIAS (unless otherwise briefed) port orbit using 30 degrees of bank until visual contact is made with the Flight Leader. At this time, the pilot plans a turn to cut across the circle, making sure that he is not cutting another aircraft out, and intercepts the rendezvous bearing. He then proceeds with a normal rendezvous. If necessary, request the leader's position. The leader will then state his position in the orbit pattern using the numbers 1, 2, 3 and 4 corresponding respectively to the orbit point, 90, 180, and 270 degrees as shown in figure 4-7. If TACAN is not available, this same procedure may be accomplished by establishing the orbit point passing over a geographical point on a base heading. UHF/ADF may be useful in picking up the leader.

RUNNING RENDEZVOUS

A running rendezvous is effected by closing on the leader from the rear on a prebriefed radial or heading. This rendezvous is usually utilized in a climb-on-course situation and should be accomplished with the leader maintaining 250 KIAS and 90 percent rpm (unless otherwise briefed). If it is effected in level flight, the leader will maintain 250 KIAS (unless otherwise briefed) at a prebriefed or designated altitude. This being the most dangerous type rendezvous due to lack of adequate depth perception and sense of closure rate by the pilot joining, requires strict compliance with proper procedures. The joining aircraft will utilize no more than a 100 KIAS closure rate. A 6 o'clock approach will not be maintained closer than 1 1/2 miles from the leader. At a minimum of 1 1/2 miles, the joining aircraft will move out to a 5 or 7 o'clock position from the leader and establish a course parallel to the leader. This course will be maintained until the joining aircraft arrives at a position abeam and has matched the leader's airspeed. The wingman will then slide laterally to the normal wing position. The use of the air-to-air (A/A) mode of the TACAN and the UHF/ADF for rendezvous

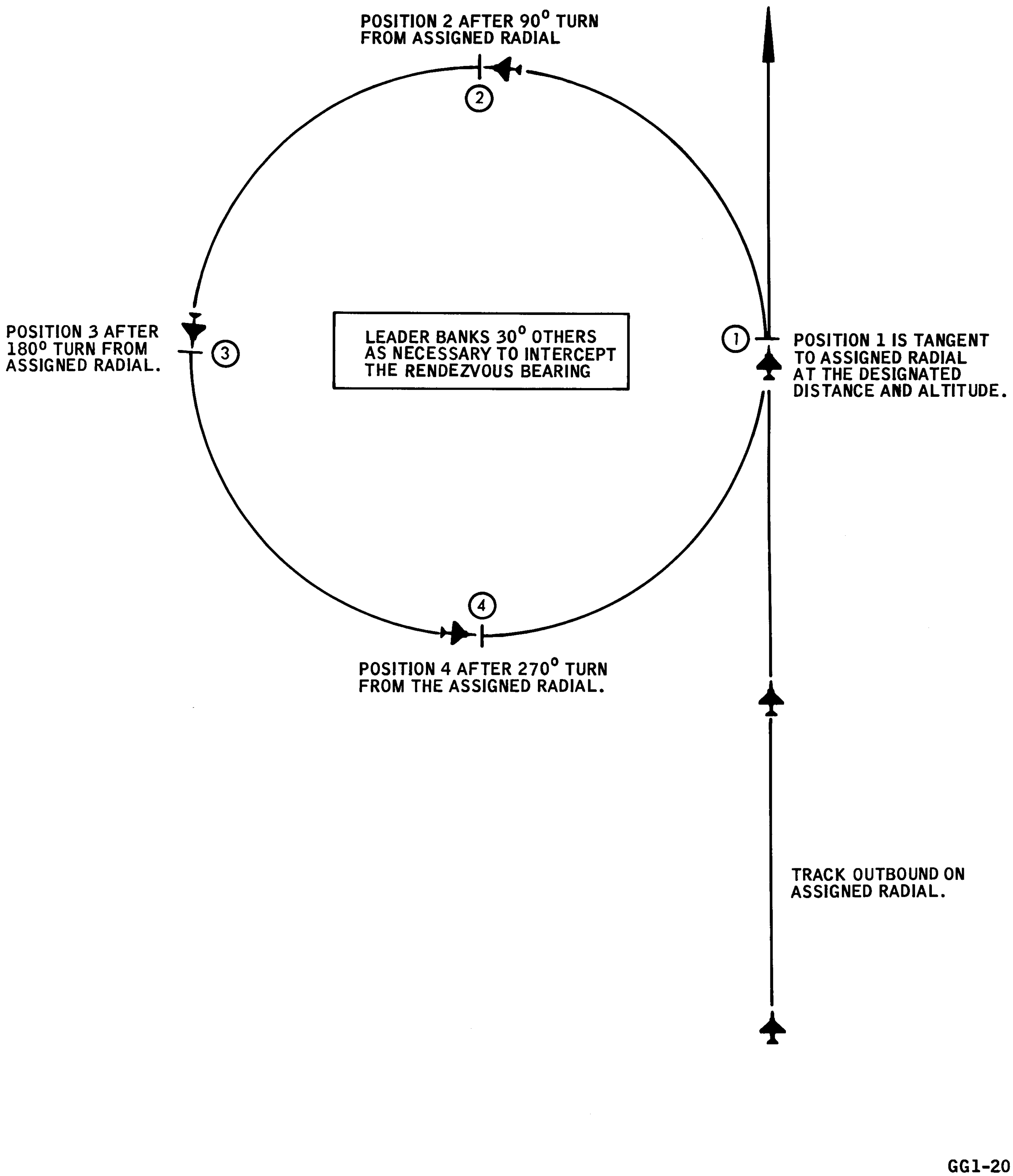


Figure 4-7. TACAN-Circling Rendezvous

during periods of darkness or reduced visibility enhances safety immeasurably and should be utilized if possible.

UHF/ADF RUNNING RENDEZVOUS

The UHF/ADF rendezvous is useful for joining aircraft under all conditions, and particularly during a straight-course running rendezvous. When used in conjunction with the air-to-air mode of the TACAN, rendezvous ability and safety are greatly enhanced. The procedure to be used for the latter is as follows:

1. Trailing aircraft select ADF position on the UHF control.

2. The Flight Leader will transmit a short count every minute, and when climbing, include the passing altitude.

3. Trailing aircraft will position themselves so that as the leader transmits the short counts, the No. 1 needle points 5 degrees left or right of the nose position. The No. 2 aircraft will hold the leader to his left, No. 3 to his right, etc.

4. As the trailing aircraft approach the Flight Leader, they will turn to keep him 5 degrees (left or right respectively) off the nose position. The amount of turn required to maintain the leader in this position will increase as the separation is reduced. Continue until visual sighting is obtained.

NOTE

Slight altitude separation may be warranted.

TACAN RANGING (A/A)

NOTE

When operating the TACAN in the A/A mode, distance to the origin of the strongest signal received will be transmitted to as many as five aircraft. This signal is not necessarily the distance to the nearest aircraft.

Air-to-air (A/A) ranging requires cooperating aircraft to be within line of sight distance. This mode enables the TACAN installation to provide range indications between one aircraft and up to five others. TACAN displays normal range and azimuth information in the T/R mode and range information only in the A/A mode (the azimuth indicator, No. 2 needle, rotates continuously).

If A/A operation is desired between two aircraft, the channels selected must be separated by exactly 63 channels, i.e., No. 1 aircraft set to channel 64, No. 2 aircraft is set at channel 1. Both aircraft must then select A/A on the TACAN function switch with the range between aircraft being displayed on the DME indicator. The maximum lock-on range is 298 miles. However, due to the relative motion of the aircraft, the initial lock-on range will usually be less.

If A/A operation is desired between one lead aircraft and five others, the channel selected by the lead aircraft may be 64, for example. The other five aircraft must be separated by exactly 63 channels, and would be on channel 1. The A/A mode must then be selected on the TACAN selector switch.

UHF/ADF CIRCLING RENDEZVOUS

If a circling rendezvous is to be made, the Flight Leader will maintain prebriefed airspeed, 30 degrees of bank, a specified altitude, and broadcast a short count and heading every minute. The trailing aircraft will correct heading to keep the No. 1 needle on the nose when the leader transmits. From the change in azimuth of the No. 1 needle between short counts, approaching aircraft will be able to determine their proximity to the lead aircraft. Approaching the Flight Leader, the needle will change more degrees in azimuth between counts, requiring larger corrections to keep the leader on the nose. At this time, the leader can probably be detected visually and a standard rendezvous completed.

LOW-VISIBILITY RENDEZVOUS/RENDEZVOUS ON DIFFERENT MODEL AIRCRAFT

This type of rendezvous should be performed in emergency situations only when directed by higher authority or when the urgency of the mission dictates. The rendezvousing aircraft should be flown at a safe maneuvering airspeed. The initial procedures will be as previously described for standard rendezvous. However, the latter stages should be modified as outlined below.

1. Establish radio contact, if possible, and determine indicated airspeed and intended flight path of the aircraft to be joined.

2. Place all lights in BRIGHT and FLASHING (if applicable).

3. Rendezvous about 1000 feet out, slightly aft of abeam (4 or 8 o'clock) the lead aircraft.

4. Cautiously close, while assuring constant nose-to-tail clearance. Maintain a constant relative bearing. Changes in relative bearing will cause foreshortening or lengthening of the aircraft fuselage and make determination of closure rate difficult.

5. A rendezvous on a different model aircraft and/or in low-visibility conditions is extremely conducive to vertigo. A high degree of caution and good judgement must be exercised throughout the rendezvous. At no time should a rapid-closing situation be allowed to develop.

SAFETY RULES FOR RENDEZVOUS

1. During all rendezvous, safety shall be the prime consideration.

2. Keep all aircraft ahead constantly in view and join in order.

3. During rendezvous, only enough stepdown should be used to ensure vertical clearance on the aircraft ahead.

4. When necessary a wingman should abort the rendezvous by leveling his wings, sighting all aircraft ahead, and flying underneath them to the outside of the formation. He should then remain on the outside until all other aircraft have joined.

5. To avoid overshooting, all relative motions should be stopped when joining on an inside wing position. A crossunder to the outside may then be made.

6. During a running rendezvous, use caution in the final stage of join-up, as relative motion is difficult to discern when approaching from astern.

Formation

SECTION TAKEOFF

The leader will position his aircraft on the downwind side of the runway. Section takeoffs will not be performed with dissimilar type aircraft, nor with a crosswind component in excess of 8 knots. Aircraft will lineup on a parade bearing with enough lateral clearance to provide separation between aircraft in case the leader experiences a blown tire, or is required to abort on takeoff. When the section is in position, the Flight Leader will give a one-finger turnup signal and both pilots will turnup to 85 percent rpm. All final checks will then be made before takeoff and each pilot will check the other's aircraft visually for leaks, trim settings, canopy closed, and flap setting.

NOTE

For section takeoffs, 6 degrees noseup trim is permissible.

When final aircraft checks have been completed, a raised hand will be signaled by each pilot, indicating that he is ready for takeoff. The leader will then drop his hand smartly out of view at brake release, for commencement of takeoff roll. Power will be smoothly advanced to MILITARY, then reduced approximately 3 percent by the leader. The wingman will adjust his power to maintain relative position. When the section is comfortably airborne, the leader will give a head nod and raise the gear. After the gear is up, the flaps will be raised above 170 KIAS. When comfortable, with gear and flaps up, the wingman may slide to a proper parade position.

PARADE FORMATION

This formation will normally be employed when operating within the airport control zone, or in conditions of low visibility and/or darkness. The Flight Leader is very restricted and must be smooth. It is recommended that all power changes, climbs, glides, and turns be signaled by the leader. Speedbrake and gear signals are mandatory. Sliding turns by the wingmen are not permitted.

SECTION. Bearing is determined by lining up the wingtip light (bright) with the break in the fuselage. Stepdown of about 5 feet is achieved by flying level with the leader's wing. The 5 feet of wingtip lateral clearance is achieved by estimating a 20-foot clearance from the wingman's cockpit to the leader's wingtip.

FOUR PLANE DIVISION (FINGERTIP FOUR). No. 3 aircraft flies identical position on leader as No. 2. A check for both aircraft being in position is to line up the tips of opposite wingman's drop tanks. No. 4 lines up canopies of No. 1 and No. 3.

ECHELON. All aircraft are on the same side of the leader. No. 3 and No. 4 line up canopies with No. 2 and leader to maintain position. No. 2 must fly with increased stepdown (eye-level with the centerline of the drop tanks).

CROSSUNDERS. Upon receipt of the crossunder signal, the wingman will acknowledge and commence an arcing crossunder by reducing power, dropping nose and sliding aft to clear the leader's tailpipe and jet wash. As the nose passes below and aft of the leader's tail, smoothly add power and complete the crossunder by sliding up and forward to the proper wing position. A section crossunder is similar with the wingman passing directly aft of the section leader as the section leader passes directly aft of the division leader. The section leader must ensure that his wingman receives the crossunder signal.

FREE CRUISE FORMATION

The free cruise formation provides better lookout capabilities and maximum freedom of movement for the leader and other members of the element.

SECTION. The bearing is 35 to 40 degrees aft of abeam-the-leader (a bearing generating from the leading edge of the leader's wing - 38 degrees). The wingman's distance out on-bearing may vary between 50 to 100 feet, depending upon the mission. This distance will always provide for a minimum of 10 feet nose-to-tail clearance when crossing under. The wingman will maintain position primarily by sliding to the inside of the leader's turns with a minimum of throttle movement. The wingman should not cruise in the leader's 6 o'clock position during turns, but remain on the inside of the turn, on-bearing. The leader cannot see the wingman while in a 6 o'clock position, and signals cannot be passed while in this position.

DIVISION. The bearing of the section leader from the leader is the same as that of the wingman. The section leader will maintain adequate distance on-bearing to give him a minimum of 10 feet nose-to-tail clearance from No. 2 aircraft, when sliding laterally. All members of the element should maintain proper nose-to-tail distance and remain on-bearing as much as possible to enable the leader to pass signals at any time and to know where element members are at all times. (No. 4 aircraft receives signals from the section leader.)

TAIL CHASE. This formation is to be used as a confidence builder and as a practical application of relàtive motion. As such, it will only be flown when specifically briefed.

Position for all aircraft is 10 feet nose-to-tail clearance with sufficient stepdown to avoid the jet wash of the preceding aircraft. The tail-on view of the aircraft should be such that the tailpipe is placed on top of the canopy bow and used as a wing position indicator. Power setting used by the leader should be commensurate with the maneuver to be performed and be considerate for the number of aircraft in the formation. Others in the flight should keep in mind that since the leader decelerates first on the climb, a power reduction will probably be necessary initially, and on dives, a throttle increase due to his accelerating first.

AIR REFUELING

See figure 4-8.

Before Takeoff

1. Ship-tank switch . . . . OFF
2. Drogue position switch. . . . . . RET
3. Refueling master switch . . . . . OFF
4. Fuel transfer switch . . . . OFF
5. Light switch . . . . BRT (DAY); DIM (NIGHT)
6. Gallons delivered indicator set to 000
7. Hose jettison switch . . . . OFF (FORWARD)
8. Ship-tank switch . . . . . . FROM STORE
9. Dump light . . . . TEST

NOTE

If there is fuel in the store, the light should come on. If there is no fuel in the store, press-to-test the light to ensure that bulb is good.

10. Ship-tank switch . . . . . . OFF

Drogue Extension

1. Refueling master switch. . . . . ON
2. Drogue switch . . . . EXT

NOTE

Be prepared for small trim changes as the drogue is extended.

3. Drogue position will read. . . . . EXT, WHEN DROGUE REACHES FULL TRAIL POSITION
4. Ship-tank switch . . . . . . TO STORE, FOR OVER 300-GALLON TRANSFER

Normal Operation

When the amber light on the tanker refueling store is on, the aircraft to be fueled maneuvers into position for probe-drogue engagement. After the probe is engaged in the drogue, the receiving aircraft must move forward (4 to 6 feet in relation to the tanker) until the store amber light goes off. As long as the two aircraft maintain this relationship, fuel transfer may be made. Actual refueling will be indicated by the green light on the store coming on. Fuel flow through the probe to the wing and fuselage tanks is automatic.

If the drop tanks are to be fueled, the drop tanks switch must be positioned at FLIGHT REFUEL. Fuel flow will then be through the probe to the drop tanks, wing tank, and fuselage tank simultaneously.

CAUTION

On all receiver aircraft that have the Air Refueling Store Control Panel installed in the left-hand console, ensure that the SHIP-TANK switch is in the OFF position before engaging in air refueling. Ensure that the EMERGENCY WING TANK TRANSFER switch is in the OFF position before engaging in air refueling.

STOPPING FUEL TRANSFER

To halt fuel transfer to the receiver at any time, place the fuel transfer switch in OFF.

NOTE

Refueling cannot be stopped by placing the refueling master switch in the OFF position. Refueling will stop if the receiver aircraft backs off enough for the amber light to come on or if the probe disengages. In either case, the drogue position indicator window will change from TRA to EXT.

To halt fuel transfer to the store, turn SHIP-TANK switch to OFF.

DROGUE RETRACTION

1. Fuel transfer switch . . . . OFF
2. Airspeed . . . . 250 KIAS OR LESS
3. Drogue switch . . . . RET

NOTE

If the drogue cannot be fully retracted at 250 KIAS, reducing airspeed to 230 KIAS or less should permit full retraction.

4. When drogue position indicator reads RET, place the refueling master switch to OFF.

NOTE

The refueling master switch may be moved to OFF at any time after the drogue has extended. In this case the tanker store propeller will feather automatically only after the drogue has returned to the retracted position.

TRANSFER FROM STORE TO WING

If it is desired to transfer fuel from the refueling store to the wing tank, place the SHIP-TANK switch to FROM STORE. This will cause both drop tank air shutoff valves and the refueling store shutoff valve to open, allowing all external tanks to be air pressurized by the engine. Fuel will then flow from the drop tanks and the refueling store to the wing tank. Transfer of fuel from the store to the wing tank is very slow but will transfer fuel at approximately the rate that fuel is burned unless high power settings are used. While fuel is flowing from the store to the wing, the dump light will be on. NEW

NOTE

If transfer of fuel from the drop tanks cannot be stopped by placing the drop tank pressurization switch on the engine control panel to OFF, check to see that the ship tank switch on the air refueling control panel is in the OFF position. If this switch is in the FROM STORE position, transfer from the drop tanks and refueling store is automatic and pressurization will be continuous unless the ship tank switch is placed at OFF.

DUMPING FUEL

An electrically operated fuel dump valve is located on the bottom of the refueling store. To dump fuel, first depress the spring-loaded lever guard assembly, then raise the master switch from the spring-loaded safety position and position at DUMP. While fuel is actually dumping, the dump light will be on. NEW

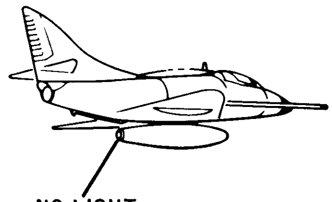
CAUTION

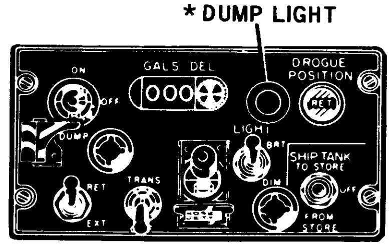
On rare occasions, fuel dumped from the store may reenter and accumulate in the aft section of the store and may create a fire hazard if the store is operated after dumping.

BEFORE LANDING

1. Ship-tank switch . . . . OFF
2. Drogue switch . . . . RET
3. Drogue position indicator . . . . RET
4. Refueling master switch. . . . . OFF
5. Fuel transfer switch. . . . . OFF
6. Drop tanks switch . . . . OFF

TANKER PANEL CONFIGURATION PRIOR TO REFUELING

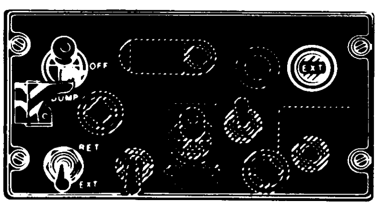


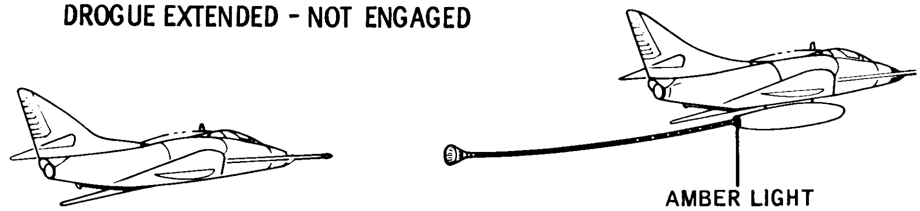


REFUELING MASTER SWITCH........... OFF
FUEL COUNTER........................ 000
DROGUE POSITION INDICATOR.......... RET
DROGUE POSITION SWITCH............. RET
TRANSFER SWITCH.................... OFF
HOSE JETTISON SWITCH (OFF=FORWARD)
LIGHT SWITCH..............(DAYTIME) BRT
SHIP TANK SWITCH................... OFF

* BY ACCESSORY CHANGE NO. 1

DROGUE EXTENDED - NOT ENGAGED

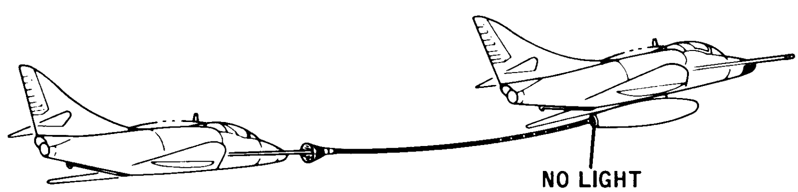


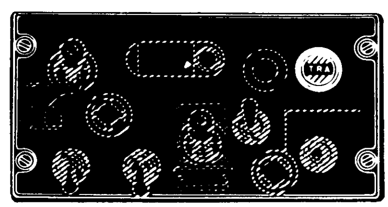


REFUELING MASTER SWITCH............ ON
DROGUE POSITION SWITCH............ EXT
DROGUE POSITION INDICATOR.......... EXT

NOTE
ON POSITION OF REFUELING MASTER SWITCH UNFEATHERS RAM AIR TURBINE FOR STORES HYDRAULIC PRESSURE.

ENGAGED - BEFORE FUEL TRANSFER

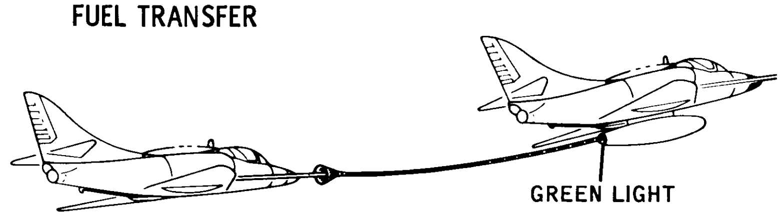




DROGUE POSITION INDICATOR.......... TRA

NOTE
COUPLING OF PROBE WITH DROGUE WHILE TRANSFER SWITCH IS OFF CAUSES DROGUE POSITION INDICATOR TO SHOW (TRA) MEANING READY TO TRANSFER.

FUEL TRANSFER



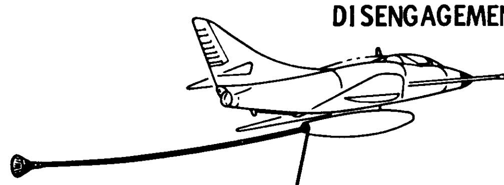
TRANSFER SWITCH.................. TRANS
FUEL COUNTER........(COUNTS GALLONS)

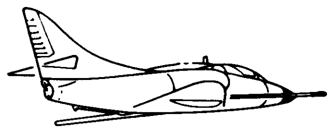
NOTE
GALLONS COUNTER CONFIRMS FUEL TRANSFER TO TANKER PILOT GREEN LIGHT CONFIRMS FUEL TRANSFER TO RECEIVER PILOT.

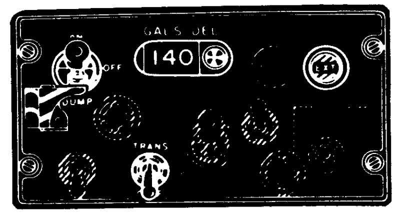
HH1-101

Figure 4-8. Tanker Operation — Air Refueling (Sheet 1)

DISENGAGEMENT





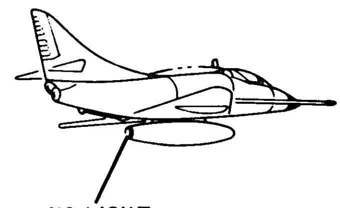


REFUELING MASTER SWITCH............ON
TRANSFER SWITCH....................OFF
DROGUE POSITION INDICATOR..........EXT

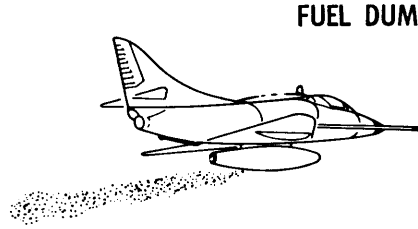
DROGUE RETRACT

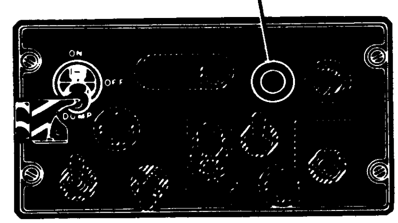
REFUELING MASTER SWITCH............ON
DROGUE POSITION SWITCH.............RET
DROGUE POSITION INDICATOR..........RET

AFTER DROGUE RETRACT
REFUELING MASTER SWITCH .... OFF



FUEL DUMP

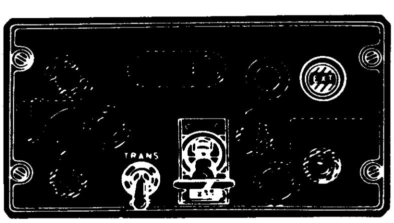




NOTE
FUEL DUMPING SHOULD ALWAYS BE DONE PRIOR TO ANY ARRESTED LANDING EITHER AFLOAT OR ASHORE.

REFUELING MASTER SWITCH.........DUMP
(ALL OTHER SWITCHES SAME AS NORMAL PANEL CONFIGURATION)

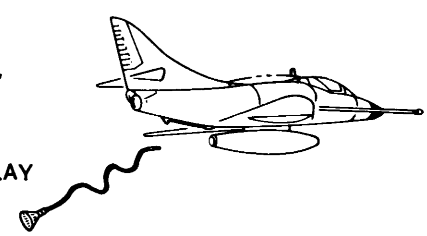
* BY ACCESSORY CHANGE NO. 1



HOSE JETTISON SWITCH HOSE JETTISON
TRANSFER SWITCH............OFF
REFUELING MASTER SWITCH..(CONDITION)
DROGUE POSITION SWITCH....(CONDITION)
DROGUE POSITION INDICATOR...EXT

HOSE AND DROGUE JETTISON - EMERGENCY

NOTE
5 TO 20 SECOND TIME DELAY IS A SAFETY FEATURE.



NOTE
JETTISONING CUTS OFF ALL STORE POWER EXCEPT POWER TO SHIP TANK SWITCH AND TO DUMP FUEL. THEREFORE FUEL DUMP IS POSSIBLE AFTER JETTISONING.

WARNING

DO NOT MOVE HOSE JETTISON SWITCH FROM HOSE JETTISON POSITION AFTER JETTISONING.

HH1-102

Figure 4-8. Tanker Operation — Air Refueling (Sheet 2)

NOTE

If practicable, open store dump valve prior to any arrested landing to ensure the store is empty. Ensure dump valve is closed prior to landing.

Jettisoning the Fueling Store

The air refueling store may be jettisoned electrically in the same manner as other droppable external stores. (Refer to section VIII, Armament System.)

Emergency Operation

Refer to section V, Emergency Procedures.

Tanker Safety Precautions

CAUTION

- Be sure that the ship-tank switch is OFF during catapulting and arrested landings. The integral wing tank pressure increases to 6 psi above ambient when the ship-tank switch is in the TO STORE position. The addition of the 6-psi static pressure to the accelerations induced by catapulting and arresting would impose severe loads on the tank surfaces.

- When the ship-tank switch is in the TO STORE position, overpressurization of the wing tank is possible if fuel covers the fuel vent outlet in the tank. This condition will exist during negative-g operation, and when the aircraft is in a nosedown attitude.

The following is a summary of the restrictions applicable to flight with the wing fuel tank pressurized:

1. Aircraft velocity not to exceed 400 KIAS
2. No catapulting
3. No landings
4. Coordinated turns only
5. Aircraft load factor limits N_2 = 0.1 to +2.0
6. No air refueling

CAUTION

- Do not start the turbine or extend or retract the drogue when over populated areas or when other aircraft are close abeam or astern.

- Do not extend the drogue after it has been retracted when a hydraulic leak has been observed.

- Do not extend the drogue if there is any evidence of a possible electrical failure.

- Do not energize the turbine after dumping fuel unless failure to provide fuel will place another aircraft in jeopardy.

- Do not actuate the speedbrakes during any part of the refueling operation.

- Once the hose jettison switch is actuated to its HOSE JETTISON position for emergency jettisoning in flight, it shall not be moved back to its OFF position. Inadvertent cycling of this switch will cause internal damage to the store and may create a fire hazard.

Store Limits

The following limitations apply to the store:

1. Maximum speed for unfeathering is 300 KIAS: for extension of the drogue and refueling, it is 300 KIAS or 0.80 IMN. The recommended unfeathering and extension speed for training is 250 KIAS or less.

2. Maximum speed for drogue retraction is 250 KIAS. (If the drogue will not retract fully at 250 KIAS, slow to 230 KIAS or less and recycle drogue.)

3. Conduct refueling operations in straight and level flight whenever possible and, if possible, do not select TO STORE until 50 gallons of fuel has been delivered to the receiver.

Pilot Technique

WARNING

When receiving fuel from a KC-135 aircraft, the maximum total fuel on board the receiver shall not exceed 4500 pounds of JP-4 or 4750 pounds of JP-5. Failure to observe these limitations may result in overpressurization and rupture of the fuel tanks due to inadequate pressure regulation of KC-135 aircraft tanker systems.

ROYAL AUSTRALIAN NAVY

SUPPLEMENT No 4

to

AP(RAN) NA01-40AVC-1 Section IV, Part 2 Page 4-22

INTRODUCTION

1. This supplement is promulgated to describe the purpose of the DUMP WARNING LIGHT fitted in A-4 Inflight Refuelling Control Console post mod. Accessory Change No 1

2. Inflight Refuelling Control Console Post Mod. Accessory Change No 1 have a DUMP warning light fitted in the right hand upper corner adjacent to the Drogue Position Indicator. This light will illuminate when fuel is being exhausted from the store either through the DUMP switch or when being transferred to the Aircraft fuel tanks via the Ship Tank switch, provided the fuel in the Buddy Store is above the minimum level set by the store float switch.

SAMR
SYDNEY
April 71

Air refueling engagements can be accomplished at any altitude within a wide range of airspeed. Successful engagements have been made between sea level and 32,000 feet at airspeeds between 190 and 300 KIAS. The optimum airspeed for engagement is approximately 230 KIAS. Use of optimum airspeed will assist the receiver in escaping heavy buffeting caused by the tanker slipstream and jet exhaust.

Closure rates above 5 knots may induce hose whip. If hose whipping or kinking occurs during normal receiving hookup, disengagement should be made immediately and the store inspected for hose tension regulator malfunction.

Thermal turbulence from the deck may be annoying for hookups at very low altitudes due to oscillatory drogue motion.

The receiver should start the engagement approach from behind and below the tanker. The receiver's flight path prior to engagement should follow the angle of the trailing drogue hose, using the drogue only as a target reference during the final 3 or 4 feet prior to contact. The receiver pilot will notice increased pitch sensitivity at this point. A slight throttle advance may be necessary to maintain a definite closing rate during the final 3 feet. To facilitate engagement at night, an air refueling probe light is mounted in the outboard leading edge of the right airscoop and is controlled by a switch located on the wedge outboard of the right-hand console.

After engaging, the receiver aircraft must move forward so that a minimum of 4 feet of hose takeup occurs, starting the fuel transfer. The store hose is striped each two feet for the last 20 feet to be unreeled. The receiver refers to these stripes to assist in maintaining a stable distance from the tanker during refueling. It is never necessary to close to a point where the stripes are not visible.

The receiver should be flown so that the hose is centered laterally and maintained just above the lower centerline lip of the store's trailing edge, but not riding on or touching the lower lip. This optimum position is approximately 2 feet below the drogue's normal trailing position. This position is the most comfortable position for the receiver to avoid severe buffeting. Once the engagement has been accomplished, it is not difficult to fly the receiver dead astern with a 2-foot lateral tolerance, even in rough air or in turns up to 30 degrees bank angle.

Mild buffeting will be felt by the receiver, but it should not be uncomfortable. Occasional mild fuel sprays of short duration may hit the receiver, but the only adverse result is possibly a greasy film on the windshield. Disconnecting is accomplished by the tanker holding constant power while the receiver retards throttle. The hose reel will unwind the takeup until it reaches the end of the hose travel and the receiver will break free.

CAUTION

Do not engage, or remain engaged to, a steadily leaking drogue. The leaking fuel will be ingested into the engine and may ignite and explode. The small amount of fuel that is leaking momentarily during plug in and disengagement is not considered dangerous.

Flight Procedures — Refueling Training and Refresher

Refueling training should be accomplished at various altitudes in accordance with current directives.

PRIOR TO REFUELING

1. After rendezvous has been effected, the Flight Leader of the receiver aircraft will position his flight in loose echelon away from the tanker on the side opposite the tanker escort, if assigned. The Flight Leader will then pass the lead to the tanker pilot if applicable.

The Flight Leader's position will be abeam the tanker with at least 200 feet separation in case a store turbine blade flies off during unfeathering.

2. When the flight is in position, the leader of the receiver aircraft or tanker escort (if assigned) will signal the tanker to unfeather (1-finger turn-up signal).

3. The tanker will unfeather, ensuring airspeed is 300 KIAS or less.

4. The Flight Leader (or tanker escort) will indicate by a "thumbs-up" or "down" whether or not the turbine unfeathered. If the turbine does not unfeather, the tanker will secure store and not make further attempts to unfeather, unless failure to provide fuel would place receiver aircraft in jeopardy.

5. If the turbine unfeathers on the first attempt, the tanker responds to the "thumbs-up" signal of the Flight Leader (or escort) by extending the drogue.

6. As the drogue extends, the flight should fall back so that leader is abeam and level with the drogue, with about 100 feet lateral separation. Drogue extension will slow tanker speed. The tanker should adjust power to maintain desired refueling speed. 230 KIAS is recommended; however, plug-ins may be made anywhere in the store operational envelope of 200 to 300 KIAS. All aircraft will remain clear of the area directly behind the drogue during extension or retraction, in the event the hose and drogue separate from the store. If drogue extension is not snubbed as it approaches the fully extended position, do not attempt plug-ins.

7. The tanker pilot, as leader of the refueling formation, has the primary responsibility for maintaining a good lookout for other aircraft, although other members of the flight are responsible for assisting to the maximum extent possible.

8. Any evidence of a hydraulic leak from the buddy store during refueling operations should immediately be reported to the tanker pilot and the store secured.

9. Do not turn pressurization to RAM while inflight refueling. Eyeball diffusers shall be turned away from pilot's face. If fuel is injected into the engine from a leaking drogue, it may appear in the cockpit as white smoke. Immediately disengage if smoke appears in the cockpit.

10. If tanker escort is assigned, the escort pilot will fly a close parade position on the tanker throughout the evolution (except during moment of unfeathering turbine) and inform tanker when the dumping has been completed. The escort will watch for store malfunctions and provide assistance in case of tanker radio failure. Tanker escort, when assigned, will give any necessary signals for actuation of turbine and drogue. The escort will not take part in the refueling sequence when another formation is refueling.

REFUELING

1. The leader should detach and move into a position 20 feet behind and below the drogue, on a plane with the trailing hose, to minimize turbulence from the tanker's wake. Call "____, lining up," before sliding into position behind the tanker. Observe amber light on tanker store, indicating store may be engaged. If light is not on, be cautious during engagement, as hose tensioning and reel-in may be inoperative. The most likely cause, however, is a burned-out bulb. Trim the aircraft slightly nose down to remove any slop from the elevator control system, and move forward and up the hose reference

until the tip of the probe is 5 to 10 feet directly behind the drogue. Pause here long enough to get stabilized, then add enough power to close and engage the drogue at a closure speed of about 3 knots. Either the tanker or the probe and drogue may be used as the primary visual reference; however, both must be perceived to make consistent and safe engagements. Closing speeds in excess of 5 knots may cause hose-whip, with ensuing damage to probe, hose and drogue, or both. Also, if misaligned at high closure speeds, damage to radome, nose section, pitot tube, or canopy may occur. If the drogue is missed, stay below the drogue and back straight out until the drogue is in sight. Avoid looking up too high for the drogue as the pilot may unconsciously pull back on the stick and climb into the drogue. Instead, use the tanker as a reference until safely aft of the drogue.

2. After engaging the drogue, continue to push in the hose until the amber light is out, and then call "____, contact." The last 20 feet of hose to unreel from the store has a white stripe every 2 feet. At least two stripes must be pushed into the store before the transfer will occur. Do not fly so close that no stripes are visible. Maintain a position so that if some opening between the tanker and the receiver occurs, the transfer will not be interrupted. This position should also be along the general reference of the hose before plug-in and will keep the nose centered slightly above the lip of the aft end of the store.

CAUTION

To preclude possible engine flameout and/or explosion, the following procedures should be used during receiver hookup. After the receiver pilot has made hookup, the tanker pilot will place the transfer switch momentarily to the transfer position and transfer 2 to 4 gallons of fuel to test for proper probe/drogue coupling. If no transmissions are heard from the receiver or the receiver does not disengage, reinitiate transfer. Excessive fuel on the windscreen, smoke or mist in the cockpit, and rising EGT are indications of possible impending engine explosion due to fuel ingestion in the engine intakes. If excessive fuel leakage is noted, the receiver pilot should notify the tanker operator immediately, retard throttle to idle and disengage from the tanker. If the IFR probe valve continues to leak excessive fuel after disengagement, full right rudder should be applied until the valve has fully closed. This will tend to cause the fuel to flow outboard of the engine intake ducts. Do not attempt further plug-ins unless low fuel state so dictates. Inspect the probe and drogue for malfunction after landing.

3. Breakaway is accomplished by the receiver reducing power in order to open from the tanker at about 3 knots. Back straight away and down, following the line of the trailing hose. Stay behind the drogue until all members of the flight are sighted. To facilitate this, it is necessary that all members of the flight properly maintain their position in echelon. When the receiver aircraft is clear of the area behind the hose and drogue, call "____, clear."

4. After breaking away, the leader will move to the opposite side of the tanker, where he will supervise the refueling, giving help as necessary. After the leader is clear of the drogue, the No. 2 man in the flight will move into position and make his plug-in. He will then disengage and join the leader in loose, outside echelon, as before. Each member in turn will make plug-ins and upon completion will move to the next position on the leader.

AFTER REFUELING

1. When all members of the flight have successfully completed the hookups and are clear of the drogue, the Flight Leader will signal to secure the store by moving the flight forward in echelon until the leader is again abeam the tanker, with at least 200 feet separation. When the tanker pilot observes the entire flight (and escort) in this position, he will retract the drogue and feather the air turbine. The Flight Leader (escort, if assigned) will indicate that the turbine is feathered by giving a "thumbs-up."

2. Upon completion of refueling, the Flight Leader should resume lead of his flight, breaking away from the tanker in an easy turn until well clear. The tanker maintains straight and level flight until adequate separation from the receiver aircraft is assured. To ensure safe separation, an altitude differential should be maintained.

Mission Refueling

Range and fuel specifics for mission refueling are covered in section XI, part 6 of this manual and in A-4/TA-4 Tactical Manual NAVAIR 01-40AV-1T and supplement.

Night Flying Procedures

Night flying procedures are identical to day procedures with the exceptions given below. Night lighting doctrine is contained in section III.

NIGHT RENDEZVOUS

Rendezvous at night are similar to daytime, except that in the final portion the pilot should try to close to a position slightly astern rather than directly toward the plane ahead. Pilots must be sure not to carry excess airspeed in the rendezvous. The leader must maintain a constant airspeed and altitude.

Whenever it is necessary for a pilot to go to the outside of the rendezvous, he will report this to the Flight Leader. Stay on the outside of the rendezvous until the remaining members of the flight have rendezvoused and then add power as necessary to join up. Pilots joining from astern will move out to the side to enhance their judgment of closure rates, as well as to ensure safe clearance.

NIGHT FORMATION

It is important to maintain the correct bearing so that the wingman can be seen by the leader. Ensure that wingtip clearance is maintained at all times. The pilot should not fly so close that he feels uncomfortable. Avoid staring at the aircraft ahead and getting fixation on its lights. Turns will be made as in instrument conditions, by rolling around the leader's axis.

Where no light signal exists for a certain maneuver, the radio should be used. Speedbrake signals may be given on the radio by transmitting "flight, speedbrakes-now." Channel changes will be given on the radio and should be acknowledged before and after making the shift.

NIGHT REFUELING

Night refueling is performed in essentially the same manner as during the day. The tanker should have all lights on BRT and STDY, except the anticollision lights. The buddy-store lights should be on DIM. The tanker lights illuminate enough of the tanker and the drogue to allow the receiver pilot sufficient light for the approach lineup. The receiver pilot should request adjustment of the tanker lights to meet his requirements.

Take up an initial position on the tanker and use the same procedures described in this section for day refueling. When in position aft of the drogue, correct altitude can be determined by the receiver pilot sensing the tanker's jet-wash on his vertical stabilizer. The receiver-aircraft lights should be on BRT and STDY. The receiver's probe light and/or fuselage light will provide sufficient illumination to see the drogue from 10 to 20 feet aft. The tendency in night air refueling is to start the approach too far aft. This makes it very difficult to judge relative motion and usually results in a high closure rate.

Banner Tow Target Operation

Refer to A-4/TA-4 Tactical Manual NAVAIR 01-40AV-1T.

result in a partial disconnect which could cause a hazardous flight condition or erratic rate of roll.

Normally, the disconnect cable will extend approximately 12 inches for a complete disconnect, and two slight jolts will be felt, evidencing the disconnect of the aileron and elevator hydraulic systems in that order. Once again it is emphasized that the boost disconnect handle should be pulled smartly, and no hesitation between each system disconnect should be attempted.

CAUTION

Hold the T-handle while allowing handle to return to the stowed position. This procedure is to prevent handle striking an instrument.

After disconnect, no trim should be used if the aircraft is controllable. If an excessive rate of roll or pitch condition exists at the present speed, and the pilot considers that the aircraft may become uncontrollable at higher airspeed, no attempt should be made to perform the rate-of-roll check. In this condition, if the pilot feels able to control an excessive rate of roll at 200 KIAS, the test may be performed the same as for the 300 KIAS test; but the angle of bank should not be allowed to exceed 30 degrees. Although not as desirable as if performed at 300 KIAS, this rate of roll will enable ground personnel to make some corrective adjustment. In this case, after the rate of roll has been recorded, the aircraft should be "slow-flighted" in the landing configuration and retrimmed if necessary for a safe landing. Speeds in excess of 200 KIAS should not be used for the remainder of the flight.

In the event the aircraft becomes uncontrollable after disconnect at 200 KIAS an emergency condition exists and the test should be abandoned. Trim should be used immediately in an attempt to stop the roll and regain control, and the throttle should be retarded to idle to reduce airspeed.

In the case of excessive nosedown pitch, it should be remembered that use of the speedbrakes may cause an increased nosedown tendency due to the design of the system.

6. Accelerate to 300 KIAS. Under normal conditions the rate-of-roll check should be performed at 300 KIAS, since the aircraft was trimmed for hands-off, straight and level flight at this speed, and it is the rate of roll after disconnect at this speed that is to be determined.

During the acceleration, straight and level flight should be maintained without use of the trim system since this will destroy the conditions for a proper rate-of-roll check. If the control forces become so severe during acceleration that control of the aircraft during an excessive rate of roll is doubtful, the test should be discontinued or performed as described in step 5.

7. Record rate-of-roll at 300 KIAS. When stabilized at 300 KIAS, wings level, time the rate-of-roll by means of a stopwatch and reference to the gyro horizon. Do not allow the aircraft to exceed 60 degrees of bank. An angle of bank in excess of 60 degrees may allow the aircraft to "fall through," increase bank rapidly, and in the case of an excessive rate of roll, cause the aircraft to become uncontrollable before corrective action can be taken.

Return the aircraft to the wings level attitude without use of trim, if possible, and repeat the test to ensure an accurate rate-of-roll recording. Four and one-half degrees per second, the maximum allowable rate-of-roll, is very slow and an error in timing is possible during the initial attempt.

8. Retrim for hands-off, straight and level flight at 300 KIAS. After determining the direction and rate-of-roll, the aircraft should be returned to straight and level flight and retrimmed to maintain this condition.

9. After the aircraft has been retrimmed at 300 KIAS, note and record the deflection angle of the followup tab and the aileron. This trim check should be performed as near hands-off stick as possible in straight and level flight. Decelerate and perform a simulated landing approach. In decelerating prior to performing the simulated approach, use should be made of all systems which may be needed in the actual landing (speedbrakes, landing gear, flaps) to determine any adverse effects they might have on the control of the aircraft with the 300 KIAS, post-disconnect aileron trim setting. Safety is of primary importance throughout the entire disconnect test, and if aileron trim is necessary after disconnect or during the landing for any reason, the pilot should not hesitate to retrim.

10. Prior to landing, the stability augmentation switch on the AFCS control panel placed in the STAB AUG position, and the spoiler switch placed in the ARM position.

Upon completion of the flight, a notation should be made on the Discrepancy Report (Yellow Sheet, OPNAV 3760-2) that the hydraulic system was disconnected; and of the direction and rate of roll, if any, and any adverse flight conditions resulting from the disconnect. This information and any pertinent remarks, which may aid other pilots or maintenance personnel in the future, should be entered in the aircraft logbook.

Hydraulic Power Disconnect with Asymmetric Loadings

Disconnect tests should not be performed with asymmetric loadings. However, in the event that an actual hydraulic power disconnect must be made with

asymmetric wing or store loadings, the following recommendations are made:

1. Speed must be reduced to less than 200 KIAS prior to disconnecting.

2. After disconnect, excessive longitudinal stick motions must be avoided.

3. Crosswind landings must be made upwind or downwind, whichever is required to put the crosswind component under the heavy or loaded wing.

4. Recommended approach airspeed is 140 KIAS with minimum final approach and touchdown airspeed of 125 KIAS. Minimum recommended lateral control speed is 115 KIAS with hydraulic power failure and up to 7500 foot-pounds asymmetric moment.

SECTION V
EMERGENCY PROCEDURES

TABLE OF CONTENTS

GENERAL

The course of action a pilot will take when faced with an emergency situation is based upon his knowledge of the aircraft and emergency procedures. For this reason, initial training must be thorough in these areas, but should not be considered complete.

Aircraft systems and procedures must be frequently reviewed on a regular basis. Periodic emergency drills in OFT/WST are ideally suited for realistic simulation of almost all emergencies that might be experienced. Above all, the pilot must be able to recognize emergency situations, analyze the possible courses of action, select the best course to follow, and then take the action necessary in accordance with the procedures of good airmanship.

1. NWP 41 (series) and supplements contains general considerations which are applicable in various emergency situations.

2. NWP 37 (series) discusses SAR organization and procedures.

3. The FLIP Enroute Supplement covers current procedures for two-way radio failure VFR-IFR, recommended procedures for any emergency phase (uncertainty, alert, distress, lost), and procedures for use with a rescue interceptor, both day and night.

4. Operation plans and orders of carrier-force Commanders and Commanders of other forces employing aircraft contain provisions for handling aircraft in distress and for rescue of personnel.

5. When an emergency is experienced while operating in the continental limits of the United States, the IFF-function select knob will be turned to the EMERGENCY position, with Mode 3 switch forward and Mode 1 code 00 and Mode 3 code 7700 set on the control panel, unless otherwise directed by competent authority.

This chapter contains the specific step-by-step procedures to be used for all emergencies likely to be encountered. Use it as the primary guide for studying remedial procedures for various emergencies. The information contained in other sections of this manual must be used to provide additional knowledge of systems operation and malfunctions.

In general, the emergencies a pilot will encounter fall into one of four categories: ground emergencies, takeoff emergencies, in-flight emergencies, and landing emergencies. It is likely that most emergencies will require some deviation from the procedure set forth for a simple failure, because of varied conditions; i.e., compounded emergencies, facilities available, weather factors. Consequently, thoughtful analysis of each situation is necessary, and the selection of the course of action to be taken rests with the pilot.

GROUND EMERGENCIES

Abnormal Starts

HUNG START

A hung start condition exists when engine appears to light-off normally, rpm stabilizes at some point below IDLE (usually 40 to 45 percent), and exhaust gas temperature (EGT) continues to rise toward maximum temperature limits. Upon determining that a hung start exists, immediately move throttle to OFF. Continue windmilling the engine with the air starter to cool turbine section and clear engine. Before attempting another start, determine that the compressor/turbine is turning freely. If the second start attempt results in a hung start, no additional starts shall be attempted until a thorough investigation has been made to determine the cause.

HOT START

Any start during which the EGT exceeds 455°C is a hot start. If the starting limit seems likely to be exceeded, immediately move the throttle to OFF.

NOTE

Continue cranking the engine, using the air starting unit.

Before attempting another start, have a crewmember check the overboard drain to make sure that fuel has drained completely from the combustion chamber.

NOTE

- If EGT exceeds 455°C five times, or reaches 531° to 565°C for 5-seconds or longer, engine must be subjected to an overtemperature inspection. An EGT exceeding 565°F for any period of time will require a teardown inspection of all hot section parts.
- Log duration and peak temperature for each start during which EGT exceeds 455°C.

FALSE START

When the engine lights-off normally and EGT remains in limits but the rpm does not increase to IDLE and remains at some lower rpm, a false start is indicated. When this occurs, or if the time from light-off to IDLE exceeds 120 seconds, retard the throttle to OFF and secure the starting air. Have the ground crew investigate the cause of the false start prior to making another starting attempt.

WET START

A wet start will occur when engine light-off is not obtained within 15 seconds. When this occurs, there will be no EGT indications and fuel vapor will emit from the tailpipe. When it has been determined to be a wet start as indicated to the pilot by ground personnel, the following should be accomplished.

Retard the throttle to the OFF position, being careful not to actuate the igniters. Proceed with CLEAR ENGINE PROCEDURE.

CLEAR ENGINE PROCEDURE

To clear the engine of excess fuel after abnormal starts:

1. Throttle . . . . OFF
2. Depress the engine starter switch, or signal ground crew to continue applying air to the engine.
3. Windmill the engine until ground personnel ascertain that the engine is clear of excess fuel.
4. Secure the starting air.

CAUTION

Upon experiencing a wet start, determine that no residual fuel remains in the combustion chamber or tailpipe before attempting another start. If residual fuel is evident and a period of time has elapsed, a close inspection must be made to ensure that no fuel has seeped under the tailpipe heat blanket before restart is attempted.

Engine Fire During Start

1. Throttle . . . . OFF

2. Manual fuel shutoff valve – EMERG OFF.

3. Apply starting air.

4. Allow starter to windmill the engine until fire has disappeared.

5. If fire is not promptly extinguished, fire guard should apply CO_2 to engine intake duct.

6. If fire persists (or if no starting unit is available), abandon aircraft.

Wing or Accessory Section Fire

If ground personnel determine that fire is in the wing or accessory section, they should signal to the pilot to abandon the aircraft, apply CO_2 to the fire, and assist in the pilot's egress as much as possible.

Before abandoning the aircraft, the pilot should perform the following:

1. Throttle OFF.

2. Manual fuel shutoff valve – EMERG OFF.

3. Secure starting air.

Brake Failure During Taxi

Effectivity: All A-4E aircraft.

1. Throttle OFF or IDLE, as needed, and transmit (identification) BRAKE FAILURE if possible before power is lost after shutdown.

2. Drop HOOK and, if at night on flight deck, turn on exterior lights.

3. Allow the aircraft to coast to a stop. In the event of a single-brake failure, use the remaining brake to stop the aircraft. Ground-loop, if required to remain on taxiway or flight deck.

4. Retract the landing gear as a last resort to stop the aircraft, if circumstances warrant.

Brake Failure During Taxi

Effectivity: All A-4F aircraft.

1. Engage nosewheel steering to maintain directional control.

2. Notify control tower.

3. In event of single-brake failure, use remaining brake and nosewheel steering to maintain directional control and to stop aircraft as required. Groundloop, if necessary, to remain on taxiway or flight deck

4. Throttle OFF.

5. Retract landing gear only as last resort to stop aircraft.

NOTE

- The landing gear handle safety solenoid must be actuated manually to move handle to UP position.
- Do not drop hook to signal brake failure aboard ship until after directional control is acquired with nosewheel steering. On A-4F aircraft reworked per A-4 AFC 429, the hook may be dropped at any time and nosewheel steering will be retained by actuating the nosewheel tailhook bypass switch, located on the control stick (figure 1-9A).
- If the engine is shut down, nosewheel steering will be lost.

Hot Brakes

1. When excessive braking has occurred (such as after an aborted takeoff), or hot brakes are suspected, notify the tower to alert the crash crew and to inform other personnel to stand clear. A dragging brake will also produce excessive heat at the wheel. In each case, the amount of heat will vary. A badly dragging brake (indicated by necessity of rpm in excess of IDLE to maintain taxi speed) could raise wheel temperatures to a point where a normal takeoff would heat the wheel enough to produce an explosive failure.

2. Taxi the aircraft to the hot-brake area. If no specific hot-brake area has been designated, taxi the aircraft clear of the duty runway and taxiways in use. Park so that the wheel axle points toward the clear area. Allow a minimum of 45 minutes for brakes to cool prior to moving.

3. If operational necessity requires immediate takeoff, leave the landing gear extended at least 3 minutes after takeoff to provide sufficient cooling of the wheel assembly to prevent explosive failure. Refer to NAVAIR Instruction 13420.1 series for additional information on this subject.

TAKEOFF EMERGENCIES

Jettison of Stores

Jettisoning stores should be considered in situations where a successful takeoff becomes questionable if continued in present configuration. Such situations might include blown tires, loss of directional control where runway departure prior to arresting gear seems likely, flap creep, improper or runaway trim settings, etc. With a properly operating engine and airspeed at or above that required for liftoff in a clean configuration, stores should be jettisoned and takeoff continued.

CAUTION

Avoid contacting the landing gear handle when using the emergency bomb release handle. A landing gear handle guard malfunction may result in raising or lowering of the landing gear.

Stores may be jettisoned using either main or emergency generator power. Select the desired position on the EMER SELECT switch and pull the emergency bomb release handle.

Aborting Takeoff

There are many circumstances that may require aborting a takeoff. Some of these circumstances are unacceptable engine acceleration check, less than normal takeoff EPR/EGT/rpm, illumination of firewarning light, runaway nosedown trim, loss of oil pressure, fuel-transfer light ON, smoke in the cockpit, abnormally slow aircraft acceleration to takeoff speed, blown tire, and loss of canopy. To successfully carry out an abortive takeoff, the pilot must be aware of the location of airfield facilities which may be at his disposal. Effects of wind component must be considered.

A takeoff abort shall be accomplished by use of arresting gear when available, unless it is certain the aircraft will be stopped or slowed to taxi speed by normal braking on the runway remaining. The procedures for takeoff abort are considered relative to takeoff refusal speed.

1. When aborting after brake release and before takeoff refusal speed the following procedures should be used:

a. Throttle to IDLE (Non-spoiler equipped aircraft, throttle to OFF)

NOTE

Best deceleration will occur by placing the throttle to IDLE until below 80 KIAS and then by placing the throttle to OFF (spoiler equipped aircraft).

b. Speedbrakes OPEN

c. Ensure spoilers ARMED

d. Stick forward

e. Simultaneously with above steps, broadcast "(identification) aborting takeoff," to warn following aircraft and tower.

f. Flaps as set

g. Braking as required

NOTE

Do not blow the tires. Maximum braking is required at takeoff refusal speed. For maximum braking apply forward stick followed immediately by moderately heavy application of brake pedal pressure. Maintain steady braking throughout the rollout to a stop or desired taxi speed, increasing brake pedal pressure as the rollout speed decreases.

h. Nosewheel steering may be used to keep the aircraft lined up with the runway centerline or return it to the centerline. If the aircraft engine is secured, nosewheel steering will become immediately inoperative due to loss of electrical power. (A-4F)

i. Hook DOWN 1000 feet prior to arresting gear, if required.

WARNING

If off-center just prior to engaging arresting gear, do not attempt to go for center of runway. Continue straight ahead parallel to runway centerline.

2. When aborting after takeoff refusal speed and abort gear is available, the following procedures should be used:

a. Throttle to IDLE (Non-spoiler equipped aircraft, throttle to OFF)

NOTE

Best deceleration will occur by placing the throttle to IDLE until 80 KIAS and then by placing the throttle to OFF (spoiler equipped aircraft).

b. Hook DOWN 1000 feet prior to arresting gear

WARNING

If off-center just prior to engaging arresting gear, do not attempt to go for center of runway. Continue straight ahead parallel to runway centerline.

c. Speedbrakes OPEN, spoilers ARM, stick forward, broadcast warning, and apply brakes, if possible.

3. If aborting after exceeding takeoff refusal speed where abort gear is not available or if the hook skips the arresting gear, decide whether to eject or remain with the aircraft. The decision to eject if the aircraft is leaving the runway or overrun must be made with consideration to speed and the nature of the surface onto which the aircraft will go.

Aborting a Section Takeoff

To avoid a collision in a section by an aircraft aborting a takeoff requires aircraft separation prior to extending the hook and aligning the aircraft on the runway centerline for the engagement of the arresting gear.

MAXIMUM BRAKING PROCEDURE

When the nosewheel is firmly on the runway and excessive crosswind does not exist, immediate moderately heavy braking should be applied. Steady braking (or pumping brakes once if pressure is low or lost) should be maintained throughout the rollout to a stop or desired taxi speed, increasing brake pedal pressure as the rollout speed decreases.

If excessive crosswind exists, apply full aileron deflection into the wind concurrent with full forward stick. Apply opposite rudder as required to maintain straight tracking down the runway. Braking can then be applied as described above if the wings are level. If the wings are not level, brake pedal pressure on the upwind side should be reduced to prevent tire blowout. External stores on the aircraft help stabilize the aircraft in crosswind conditions and allow heavier braking than a clean configuration aircraft.

BLOWN TIRE ON TAKEOFF

If a tire blows on takeoff, the pilot must decide whether to abort or continue the takeoff. The following generalities are pertinent.

1. If a tire blows early in the takeoff roll before a moderate amount of rudder effectiveness is available (about 70 KIAS), the takeoff should be aborted. Below 60 KIAS, maintain directional control using nosewheel steering (A-4F) or brakes (A-4E).

2. At high gross weights where takeoff distance utilizes most of the runway, increased drag of the blown tire may preclude successful takeoff. Abort the takeoff at any airspeed if arresting gear is available and if it is apparent that lift-off cannot be accomplished prior to reaching the end of the runway.

3. If a successful takeoff is made with a blown main or nose tire, after airborne, delay retraction of the landing gear until rotation has ceased. If possible, obtain a visual check of tire by another aircraft to determine whether retraction can be safely accomplished without the wheel hanging up in the wheel well. Usually, the tire will be hot, and a minimum of 3 minutes should be allowed with the gear extended to permit the tire to cool.

4. The braking effectiveness of a blown tire is less than that of a tire in good condition. Consequently, to deliberately blow a good tire to "balance" another that has blown is not good procedure.

Runaway Nosedown Trim

If unable to rotate the nose to a takeoff attitude 5 knots below the predicted takeoff airspeed, the pilot must decide whether to abort, apply corrective noseup trim (using the manual override), or eject. Foresight can prevent this situation. Use the takeoff checkoff list on the instrument panel immediately prior to takeoff roll and glance at the trim indicators when approaching lift-off distance. An added precaution is to ensure that the stick is grasped in a manner that the trim button cannot be moved inadvertently.

Engine Failure During Takeoff

If engine failure is suspected during takeoff, ascertain that the throttle is at MILITARY. Improper adjustment of the throttle friction may allow the throttle to retard, thereby giving the impression of engine failure. In the event of a confirmed engine failure, fire, or structural failure, abort the takeoff, as above. If the aircraft cannot be stopped on the runway remaining, or if airborne, EJECT. Minimum NEW ejection airspeed in A-4E aircraft not reworked per A-4 AFC 359 is 90 KIAS.

Engine Failure During Catapulting

In the event of a confirmed engine failure during catapulting, EJECT. If unable, ditch the aircraft straight ahead in a nose-high (but not in a stalling) attitude to prevent diving after contact with the water. Accomplish the following, if time permits:

1. Landing gear handle . . . . UP
2. Emergency bomb release. . . . . PULL
3. Throttle . . . . OFF
4. Canopy jettison handle. . . . . PULL
5. Remain braced until all shocks stop.
6. Emergency oxygen ring . . PULL
7. Harness release handle . . PULL

Refer to Ditching and Underwater Escape.

Engine Failure After Takeoff

If the engine fails after the aircraft becomes airborne and insufficient runway remains to make a safe landing, convert excess airspeed to altitude. Buffet onset indicates attitude which will provide maximum altitude gain. Ensure that power loss is not due to inadvertent retarding of the throttle because of insufficient throttle friction. If time permits, extend emergency generator and jettison external stores. EJECT at or just prior to the peak altitude while the aircraft is still ascending. If unable to eject, accomplish as many of the following as possible.

1. Throttle . . . . OFF
2. Landing gear . . . . UP, IF INSUFFICIENT RUNWAY REMAINS FOR LANDING
3. Emergency generator . . . EXTEND
4. Emergency bomb release handle . . . . PULL
5. Flaps . . . . AS SET
6. Manual fuel shutoff valve . . . . EMERG OFF
7. Land straight ahead . . . . (REFER TO FORCED LANDINGS.)

JATO Bottles Failure

If the JATO bottles fail to fire, either continue the takeoff or abort as determined from the takeoff charts in section XI. If the JATO bottles cannot be jettisoned after takeoff, continue mission if operational situation warrants, or dump down below maximum permissible landing gross weight and land.

Retraction Safety Solenoid Inoperative

To raise the gear with the retraction safety solenoid inoperative:

1. Obtain visual check of main landing gear mounts to ensure proper strut extension.

CAUTION

Retraction safety solenoid failure may result if the left main mount is not fully extended. If an attempt is made to raise the landing gear when this solenoid failure occurs, the tire and wheel assembly may hang up, resulting in a wheels-up landing. Retraction safety solenoid failure may also result from inadvertent emergency generator extension, dc converter failure, or microswitch failure.

2. Release landing gear control lock and rotate gear handle toward UP position.

3. Move retraction release switch aft and simultaneously raise gear handle to full UP position.

Unsafe Gear-Up Indication

Gear indications of UNSAFE, after gear retraction cycle is completed, are usually caused by faulty microswitches, failure to remove the landing gear safety pins, or, in the case of the nose gear, possibly by nose strut overinflation. For UNSAFE condition, proceed as follows:

MAIN GEAR UNSAFE OR DOWN, GEAR HANDLE UP

1. Maintain 225 KIAS or less.

2. Cycle gear in attempt to obtain UP indication.

3. If unable to obtain UP indication by cycling, have other aircraft or ground personnel visually check main gear. Continue mission if gear doors are closed and flush with aircraft. Otherwise, dump excess fuel and land.

NOSE GEAR UNSAFE OR DOWN, GEAR HANDLE UP

1. Maintain 225 KIAS or less.

2. Have other aircraft or ground personnel visually check nose gear to determine whether nose gear door is closed and flush with aircraft. Cycle gear, if door is reported to be closed, in attempt to obtain UP indication. Continue mission.

3. If a visual check cannot be made, lower gear as soon as practicable, dump excess fuel and land. Do not cycle gear.

4. If visual check indicates that nose gear is not fully retracted or that nosewheel door is not fully closed, do not cycle. Lower gear as soon as practicable, dump excess fuel, and land.

Flight Control Disconnect

If a flight control disconnect has occurred, greater than normal stick forces will be required to counteract the positive pitching moment at takeoff. Leave the flaps down to reduce trim changes, and use longitudinal trim as required to control the aircraft. Do not let angle-of-attack become too high. Comply with the procedures for a flight control disconnect.

PARTIAL DISCONNECT OF ELEVATION POWER SYSTEM

The hydraulic flight control power system will not disconnect in flight unless the pilot pulls the manual flight control T-handle or the elevator hydraulic power system is partially latched. A partially latched condition can result only from improper resetting of the elevator power mechanism after a disconnect or from the release cable being inadvertently pulled, especially when working through the lower engine access doors. A partially latched condition of the elevator hydraulic power mechanism will not be detectable from stick response prior to flight. Air loads on the elevator can cause partial disengagement of the elevator power cylinder at or shortly after takeoff. Partial disengagement of the power cylinder causes loss of the elevator hydraulic flight control in the nose down direction only, without shifting to the manual mode.

With a partial elevator power disconnect the aircraft will be flyable, but forward elevator control is not available. Neutral or in-trim position of the stick will be aft of normal stick position. Forces to move the stick forward of neutral will be markedly higher, but forces will be normal for stick motion aft of the neutral point. Full nose down trim will be needed to minimize the strong nose-up tendency of the aircraft. A climb should be established leaving the flaps down to increase the aircraft's nose down trim while adjusting power to maintain a safe flying speed.

WARNING

Pulling the manual flight control T-handle with a forward force on the stick will prevent complete shifting of the elevator power mechanism to the manual flight control mode.

The hydraulic power system should be disconnected after reaching a safe altitude by sharply pulling the manual flight control T-handle without any force on the control stick.

The flight control hydraulic power system should not be disconnected with a hydraulic system functioning if the flight controls appear to be jammed or malfunctioning in some other manner than the partial elevator power system disconnect described above.

IN-FLIGHT EMERGENCIES

Engine Malfunctions

CHUGS AND STALLS

Possible causes are icing, PRIMARY fuel control failure, rapid engine acceleration while operating at excessive angle-of-attack at high altitudes, adding throttle too fast while operating in MANUAL fuel control, or malfunctioning compressor bleed valve control.

1. Reduce power as necessary to regain normal operation. If chugs/stalls persist, decrease angle-of-attack and increase airspeed if possible. If this is ineffective, shift to MANUAL fuel control.

2. If icing is suspected turn on engine anti-icing system, shift to MANUAL fuel control, and change altitude, if possible.

3. If stalled condition persists, secure engine and perform air start.

4. If chug/stall is pilot induced and no other adverse symptoms are apparent, continue the flight, but record the circumstances upon return.

RPM/EGT MALFUNCTIONS

Fluctuating rpm not corresponding to similar indications of fuel flow, EPR, or EGT should be assumed to be a faulty tachometer system. Use airspeed and throttle position for power reference if

RPM is unreadable. If fuel flow or EGT is also fluctuating, assume a PRIMARY fuel control malfunction and shift to MANUAL fuel control.

Fuel flowmeter, EGT, or EPR fluctuations should be treated similarly; i. e., unless engine performance is determined to be erratic from more than one source, assume an instrument error. Otherwise, shift to MANUAL fuel control.

ENGINE OVERTEMPING

During climbs or sustained operations of MILITARY power, minor engine overtemping (5°C or less) may occur. This overtemping should be controlled by reducing RPM slightly to maintain EGT within limits. If overtemping recurs at the reduced RPM or is in excess of 5°C, land at the nearest suitable landing facility as soon as possible unless other action is indicated.

FUEL-BOOST PUMP FAILURE

With an inoperative boost pump, gravity flow of fuel to the engine-driven fuel pump provides an adequate supply of fuel for all power conditions up to 6000 feet, and for continued operation at reduced RPM at higher altitudes.

NOTE

There have been repeated instances of successful full power operation at 35,000 feet.

When the boost pump fails, reduce throttle to minimum required. Avoid zero g, negative g, or inverted flight. Ensure positive g during speedbrake operation.

THROTTLE LINKAGE FAILURE

No provisions are incorporated for automatic positioning of the fuel control in the event of throttle linkage failure. The engine may accelerate to MILITARY, remain as is, retard to IDLE, or flame out. If the throttle linkage breaks and the engine RPM permits continued flight, attempt a precautionary approach modified as necessary. If it becomes necessary during flight or after touchdown, secure engine using the manual fuel shutoff control lever. The time from actuation of the control lever until the engine shuts down will be approximately 4 seconds.

LOSS OF THRUST

Possible causes are inadvertent reduction of throttle, broken throttle linkage, PRIMARY fuel control failure, or icing.

1. Check throttle for position and engine response.

2. Shift to MANUAL fuel control unless other action is indicated. (See Fuel Control Malfunctions.)

3. If icing is suspected, shift to MANUAL fuel control and change altitude, if possible. Turn on engine anti-icing system.

4. If flameout occurs, secure engine and perform air start. (Refer to Air Start.)

5. For loss of thrust occurring under low altitude/high airspeed conditions, refer to Low Altitude Loss of Thrust/Flameout.

LOW-ALTITUDE LOSS OF THRUST/FLAMEOUT

When loss of thrust occurs under low-altitude/high airspeed conditions, the heavy demands on the pilot in the brief time available make it difficult to determine whether flameout has occurred, or whether the engine is still running at, or near, IDLE. Because of this and the fact that time available usually precludes a complete AIR START, the following procedure is recommended.

1. Commence zoom climb

2. Switch fuel control to MANUAL.

3. Hit igniters and return throttle to IDLE.

4. Cautiously advance throttle and ascertain restoration of thrust.

5. If engine fails to respond adequately, and peak altitude at zoom apex is less than 5000 feet, EJECT. If time and altitude permit, establish 250-KIAS glide and commence AIR START procedures.

FUEL CONTROL MALFUNCTIONS

A malfunction of the fuel control unit may result in fluctuating RPM and exhaust temperature, a sudden drop on the fuel flow indicator, or a complete loss of power. When any of these occur, proceed as follows:

1. Throttle . . . . match with rpm

2. Fuel control switch . . . . MANUAL

NOTE

If a shift from MANUAL to PRIMARY is made, perform the shift between 80 to 85 percent rpm to minimize the risk of flameouts and to prevent possible compressor stall when switching.

3. Advance throttle slowly and smoothly to desired power setting.

CAUTION

Do not reset fuel control to PRIMARY after air start unless flameout is known to have been caused by other than engine fuel system malfunction. Operate throttle cautiously so as not to exceed rpm and temperature limitations when operating in MANUAL. If shift from MANUAL to PRIMARY is made, perform the shift between 80 to 85 percent rpm to minimize the risk of a flameout.

ABNORMAL OIL PRESSURE

If abnormal or significant changes in oil pressures are noted, gradually adjust engine speed to the minimum required for level flight to the nearest suitable landing facility and execute a precautionary approach to landing. The reduction of engine speed below that required for level flight is not recommended until landing on the runway is ensured, or until the decision is made to eject. Increased engine friction may prevent the engine from accelerating once the throttle has been retarded. With a bearing failure, operation at very low power settings may hasten engine seizure.

NOTE

- Maneuvers producing acceleration near zero g may cause a temporary loss of oil pressure. Absence of oil pressure is permissible for a maximum of 10 seconds.
- Electrical power failure causes the oil pressure gage to be inoperative. Deploying the emergency generator should correct this condition.

LOW OIL QUANTITY

If the oil quantity light (OIL LOW) comes on during flight, abort the flight using a precautionary approach to landing at the nearest suitable landing facility.

ENGINE-DRIVEN FUEL PUMP

When the engine-driven fuel pump fails, a flameout will occur and no relight is possible.

Engine Failure

Symptoms of imminent engine failure, singly or in combination:

1. Loss of thrust not due to throttle movement or icing.

2. Fluctuating rpm, EGT, and EPR not eliminated by shifting to MANUAL fuel control.

3. Abnormally high EGT in relation to engine rpm.

4. Oil pressure dropping, or less than 40 psi.

5. Abnormal vibration, or loud or explosive sounds apparently emanating from the engine.

If any of the above symptoms appear, gradually adjust power to the minimum rpm required for level flight and land as soon as possible, executing a precautionary approach, at the nearest suitable landing facility.

PROCEDURE ON ENCOUNTERING ENGINE FAILURE

FLAMEOUT. When engine failure occurs, quickly retard the throttle. The engine might run at some reduced thrust setting if the throttle is retarded to a point at which the engine is "caught" before engine flameout occurs. When the loss of thrust cannot be prevented by this action, proceed as follows:

1. Throttle . . . . OFF

2. Emergency generator . . . . EXTEND

3. Check for evidence of fire. (Refer to Fire.)

4. If fire is present or existed prior to shutdown, do not attempt to restart engine. (Refer to Ejection.)

5. If no fire exists, start the engine as described in Air Start.

LOW-ALTITUDE AIRSTART

Refer to Low-Altitude Loss of Thrust/Flameout.

AIRSTART

1. Throttle . . . . OFF
2. Emergency generator . . . . EXTEND

NOTE

Ensure NORMAL/BYPASS switch is in NORMAL position.

3. Fuel control switch. . . . . PRIMARY/MANUAL

NOTE

- Successful airstarts can be obtained at any airspeed and altitude combination within the prescribed airstart envelopes of figure 5-1. Unless fuel control malfunctions exist, airstarts may be made with PRIMARY fuel control selection.
- Avoid negative g flight to prevent air being trapped in the engine-driven fuel pump inlet line, and to minimize fire hazard.
- In J52-P-8A engines having reduced smoke burner cans incorporated (PPC-185), metering of fuel flow below 250 KIAS in manual fuel control is required.

4. If practicable, descend to 30,000 feet or below, at best glide speed (figure 5-2).

5. Establish 250 KIAS glide.

6. Throttle . . . . IGN THEN IDLE

7. When below 250 KIAS, in manual fuel control and with PPC-185 incorporated:

Throttle . . . . IGN THEN 500 PPH (JP-4)
600 PPH (JP-5)

NOTE

At speeds below 250 KIAS, and when in manual fuel control, airstarts of J52-P-8A engines having reduced smoke burner cans incorporated (PPC-185) will require placing the throttle short of idle and metering the fuel flow until approximately 60 percent rpm is attained.

8. Monitor RPM and EGT. In MANUAL fuel control it may be necessary to meter fuel by adjusting throttle position between OFF and IDLE to maintain EGT within limits and avoid rpm hangup.

CAUTION

Do not reset fuel control to PRIMARY after airstart unless flameout is known to have been caused by other than engine fuel system malfunction. Operate throttle cautiously so as not to exceed rpm and temperature limitations. If shift from MANUAL to PRIMARY is made, perform shift between 80 to 85 percent rpm to minimize risk of flameout.

9. If relight does not occur within 30 seconds (JP-4) or 45 seconds (JP-5), retard throttle to the IGN position, then return to IDLE. The JP-5 fuel does not light as readily as the JP-4, therefore the ignition timer sequence must be renewed to ensure spark is available for lightoff. Optimum relight range of fuel flow is 500 to 850 pph. JP-4 lights more readily at the lower part of the fuel flow range, JP-5 at the higher part.

MAXIMUM GLIDE ENGINE WINDMILLING. The recommended speed for maximum gliding range is approximately 200 KIAS for gross weights up to 14,000 pounds, clean configuration, and altitudes up to 45,000 feet. See figure 5-2 for approximate gliding ranges from various altitudes. For each 1000-pound increase over 14,000 pounds, increase airspeed by 5 knots. The maximum gliding range angle of attack is 9.5 units with or without stores.

Fire

ENGINE FIRE

Illumination of the FIRE warning light is usually the first indication of fire or overheat condition in the engine compartment or tail section. The pilot should be alert for corroborating evidence that a fire actually exists before executing any drastic emergency procedure based on illumination of the FIRE warning light.

An actual fire will almost always be accompanied by one or more of the following:

1. Scorched or pungent odor in the LOX system.
2. Emission of smoke or flames from the tailpipe or other area.
3. Flickering or steady ladder lights, stiffening in elevator or aileron control pressures, partial or complete loss of one or more flight controls, or abnormal flap indications.
4. Explosion or unusual vibration.
5. Rising EGT and decreasing rpm; excessive EGT.

One or more of the above indications may be used to confirm a FIRE warning light indication that a fire exists. The possibility exists that a fire could be present without illumination of the FIRE warning light. Whenever possible, confirmation of fire indications should be made through visual sighting by the pilot, a wingman, or other personnel, if practicable.

If the FIRE warning light comes on, the pilot should perform one of the following two procedures, depending on the presence or absence of other indications of fire.

FIRE WARNING LIGHT – OTHER INDICATIONS OF FIRE

1. Throttle . . . . OFF
2. Manual fuel shutoff lever . . . . . EMERG OFF

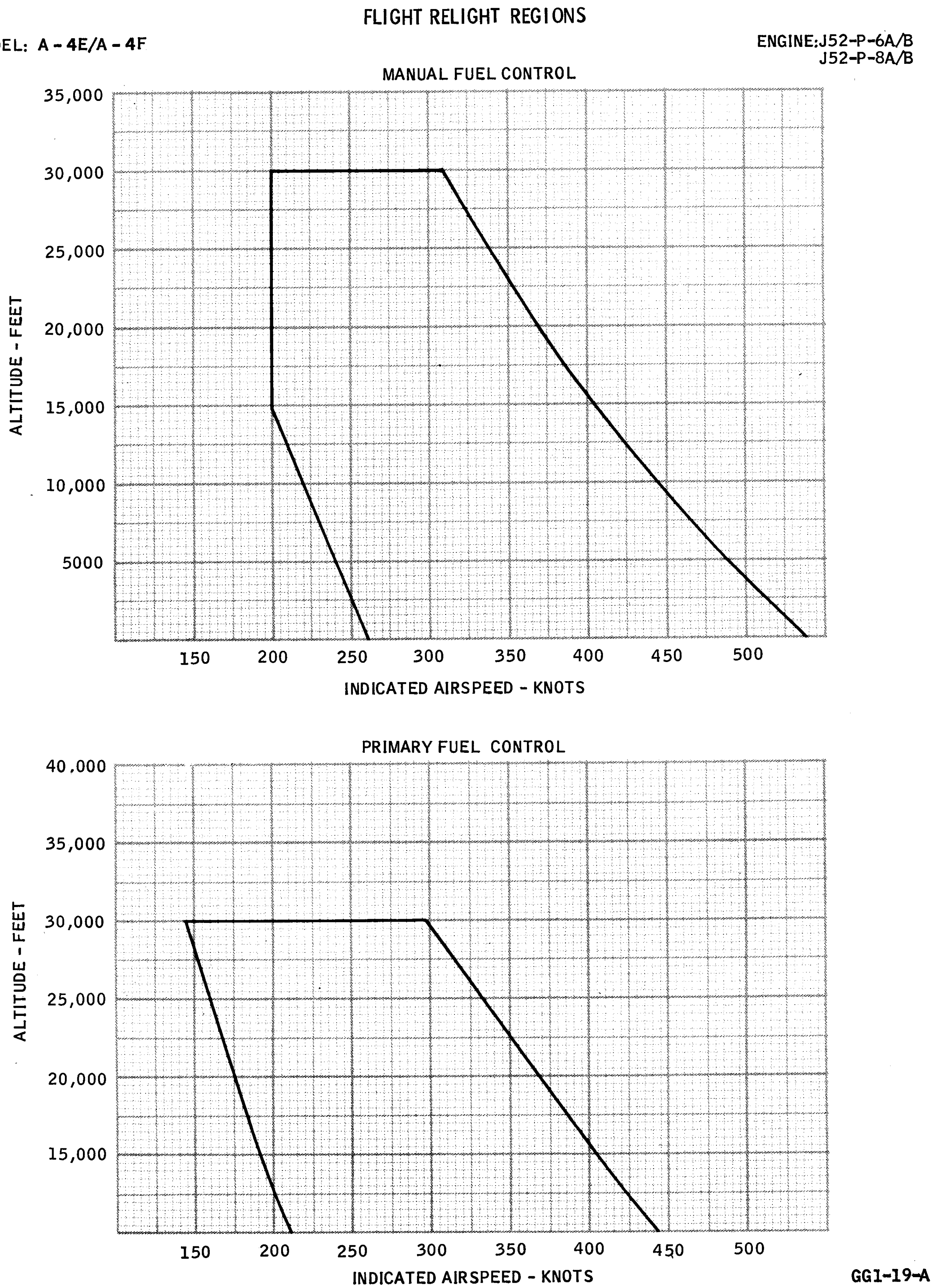


Figure 5-1. Flight Relight Regions

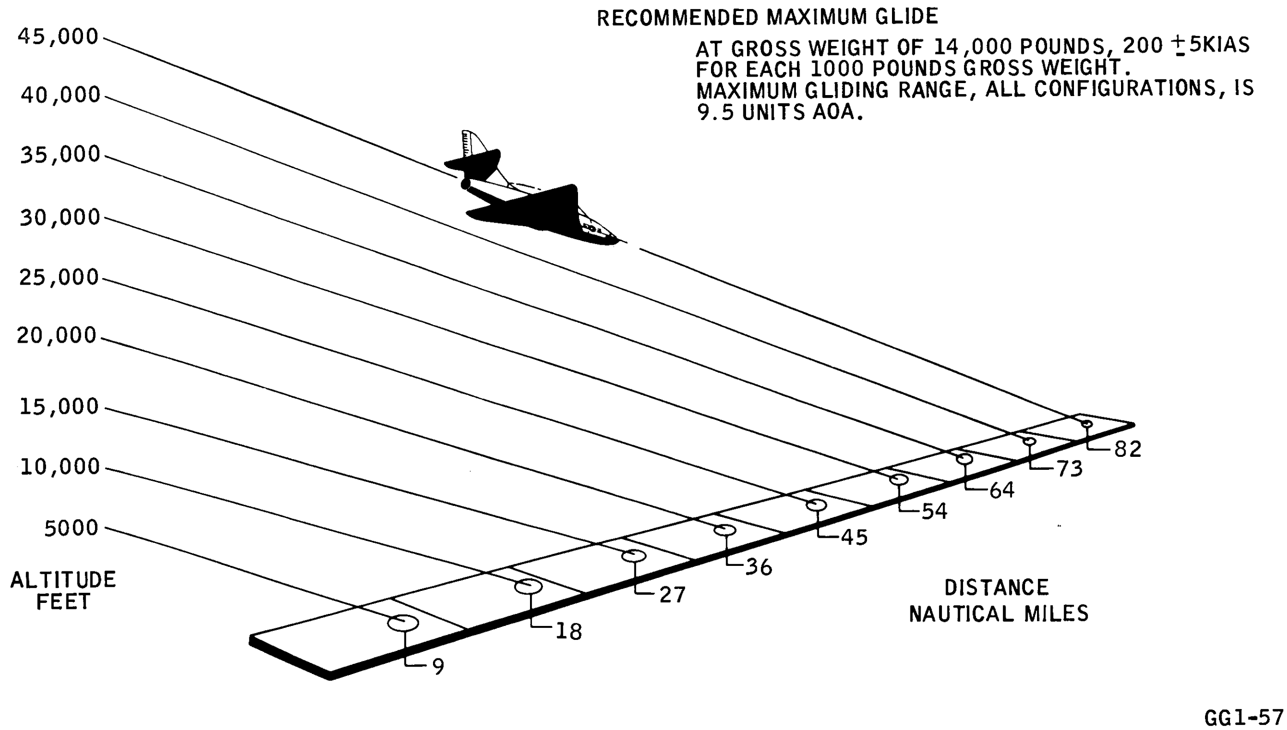


Figure 5-2. Maximum Glide

3. Emergency generator . . . EXTEND

4. If the fire is extinguished by moving the throttle to OFF and cutting off the fuel supply to the engine, as evidenced by the FIRE warning light going off and the disappearance of other indications of fire, do not attempt to restart the engine. Depending on the sequence of events and indications, immediate ejection may be indicated. However, the pilot must decide when to eject, taking into consideration aircraft altitude, attitude, airspeed, and condition; weather; chances for improving rescue/survival environment by gliding toward land or a ship; and other factors. (Refer to Ejection.)

FIRE WARNING LIGHT – NO OTHER INDICATIONS OF FIRE

1. Throttle . . . . minimum required for flight.

2. Be alert for other indications of fire. Whenever possible, have wingman or other personnel visually check for smoke or flames. If no one is available to make this check, the pilot should bank the aircraft and observe his flight path for smoke. If fire is confirmed, proceed as outlined in Fire Warning Light – Other Indications of Fire.

3. If there is no other indication of fire, it is most likely that a false FIRE warning light indication exists.

4. Land as soon as possible at the nearest suitable landing facility. If there is any evidence that a fire actually exists, shut down engine immediately after touchdown. Move manual fuel shutoff control lever to EMERG OFF. Abandon aircraft as soon as the aircraft comes to a stop.

WING FIRE

A fire in the wing could be caused by either fuel leakage or defective electrical wiring.

1. Jettison all combustible external stores.

2. Follow procedure for electrical fire, if indicated.

3. If fire continues to burn or is obviously fuel-fed, EJECT.

ELECTRICAL FIRE

When a fire seems to be electrical in origin proceed as follows:

1. Turn OFF all electrical equipment.

2. If fire persists, extend emergency generator.

3. If fire is extinguished, turn ON only necessary equipment, one at a time. If offending circuit is again energized, secure it.

4. If fire cannot be extinguished in this manner, the pilot must decide whether to land as soon as possible or EJECT.

NOTE

Deployment of the emergency generator may deactivate the defective circuit.

SMOKE OR FUMES

There are several sources of smoke or irritating fumes in the cockpit:

1. Air conditioning system

2. Bleed-air line may not be connected to the g suit valve, or there may be an improper assembly of the valve

3. Torn canopy seal

4. Bleed-air line may not be connected to the turn-and-slip indicator.

5. Electrical fire in the cockpit.

Note that selecting RAM on the cabin-pressure switch will correct only the smoke or fumes from the first source listed, while all others remain unaffected.

ELIMINATION OF SMOKE OR FUMES

1. Eliminate the possibility that smoke or fumes are mistaken for fog from the air conditioning system by increasing the temperature control to AUTO HOT.

2. Select RAM.

3. If the smoke or fumes are not eliminated, lift the oxygen mask for a cautious smell. Do not inhale deeply because of the possible presence of oil fumes (Spec MIL-L-23699) which are highly toxic.

4. If the odor smells like burning or hot electrical insulation, proceed as in Electrical Fire.

5. If it is determined that the smoke or fumes are not electrical in origin, be alert for other evidence of fire (Refer to Fire.)

6. If the smoke or fumes cannot be eliminated and so limit the vision that a safe landing could not be made, or if they are accompanied by excessive cockpit temperatures, jettison the canopy.

NOTE

Slow aircraft as much as possible prior to jettisoning canopy.

7. Land as soon as possible.

Ejection

Ejection may be necessary as a result of fire, engine failure, structural failure, midair collision, or when the aircraft becomes uncontrollable. In each case, the pilot must decide when to eject, using the following as a guide:

1. Ejection is mandatory under the following conditions, except when unusual circumstances clearly indicate to the pilot that the cause of safety to himself and others will be better served by a flameout approach than by ejection.

Serious, uncontrolled fire.

If the aircraft is in uncontrolled flight at 10,000 feet AGL or below.

When engine flameout occurs below 1500 feet AGL and 250 KIAS.

If repeated relight attempts are not successful between 30,000 and 10,000 feet, eject by 10,000 feet AGL.

If still on first or second relight attempt when passing through 10,000 feet AGL and it appears that a relight is likely, air start attempt may be continued to a minimum of 5000 feet AGL.

Certain landing-gear configurations. (Refer to figure 5-13.)

2. If the engine flames out below 10,000 feet AGL, zoom to convert excess airspeed to altitude. Attempt an air start as time permits. If the peak altitude is 5000 feet AGL and the air start attempt is not successful, eject no lower than 5000 feet AGL. If the peak altitude is below 5000 feet AGL and an air start attempt is made during the zoom and there is no evidence of a relight, eject at the peak altitude. If no air start attempt is made, eject at the peak altitude.

3. If the decision to eject is made at high altitude, it is recommended that the pilot eject at a minimum of 10,000 feet AGL, or higher, if conditions so indicate. (See figure 5-3.)

Using the rocket-catapult seat in A-4E aircraft reworked per AFC 359, ejection may be accomplished on the ground at zero airspeed and above. Without incorporation of AFC 359, minimum airspeed for ejection is 90 KIAS. Ejection may be accomplished with either system at all other altitudes and airspeeds within the flight range of the aircraft (figure 5-4), except for abnormal flight conditions of steep angles of bank (or inverted flight and high rates of descent at very low altitudes).

Using the ESCAPAC 1C-3 ejection seat (all A-4F aircraft), ejection may be accomplished on the ground at zero airspeed and above, and at all other altitudes and airspeeds within the flight range of the aircraft (figure 5-4), except for abnormal flight conditions of steep angles of bank (or inverted flight and high rates of descent at very low altitudes). For all practical purposes, in predicting minimum terrain clearance altitude (figure 5-8) from the charts, dive angle and angle-of-bank chart altitudes are additive up to 60 degrees dive. In steeper dives, bank angle is negligible. The possibility of injury to shoulders and hips from flailing, and wind-blast damage to personal gear, makes it imperative that the airspeed be reduced to 350 KIAS or less prior to ejection whenever possible. Inverted and severe yaw positions should be corrected, if feasible, prior to ejection, and every attempt should be made to reduce speed.

Usually, the pilot will have time enough to do several things to prepare himself for a successful ejection prior to pulling the face curtain. However, when the emergency condition requiring ejection is such that ejection must be made without hesitation, simply grasp the face-curtain handle (or alternate ejection handle) and pull forceably to the fullest extent until seat ejects.

EJECTION SEQUENCE

Refer to figures 5-4 and 5-5 for ejection sequence.

CONTROLLED EJECTION

The following procedure is recommended, if time permits:

1. Throttle . . . . IDLE
2. Slow aircraft as much as possible
3. Seat . . . . full down position
4. Emergency generator . . . . As required
5. IFF . . . . EMERGENCY
6. Transmit MAYDAY position report.
7. Shoulder harness . . . . locked
8. Visor . . . . down
9. Air conditioning switch . . . . . RAM
10. Leave feet on rudder pedals
11. Sit erect, with spine straight and head firmly against headrest.
12. Grasp face curtain handle with both hands and pull down forcefully to fullest extent. The canopy should jettison when the curtain is pulled over the helmet and the catapult should fire when the handle passes the nose or chin. A canopy interlock prevents firing of the catapult before the canopy is jettisoned. Consequently, if the curtain is pulled very fast, the interlock may cause a pause or stop and the force of the continued pull on the face curtain may not be sufficient to effect catapult firing. It will then be necessary for the pilot to jerk as hard as possible on the face curtain to obtain sufficient pull force. If the seat still does not fire, release the face curtain and apply a strong, steady, two-handed pull on the alternate ejection handle.
13. If pulling on face curtain (or alternate ejection handle) fails to jettison canopy, perform the following emergency procedure:
   a. Retain a firm grip on face curtain (or alternate ejection handle) with one hand, but do not pull it farther out. Hold elbow inboard.
   b. PULL canopy-jettison handle firmly.
   c. After the canopy leaves, continue pulling face curtain (or ejection handle) with both hands.
   d. As a last resort, if the canopy still remains, it may be removed by the force of the airstream by unlatching canopy manually, if airspeed is in excess of 125 KIAS.

WARNING

Beware of a rapid rearward movement of the canopy lever when this is done.

Retain the face curtain (or alternate ejection handle) with one hand during this procedure.

14. If ejection occurs above the preset altitude, the parachute will not deploy automatically until after descent below the preset altitude (14,000 feet). If

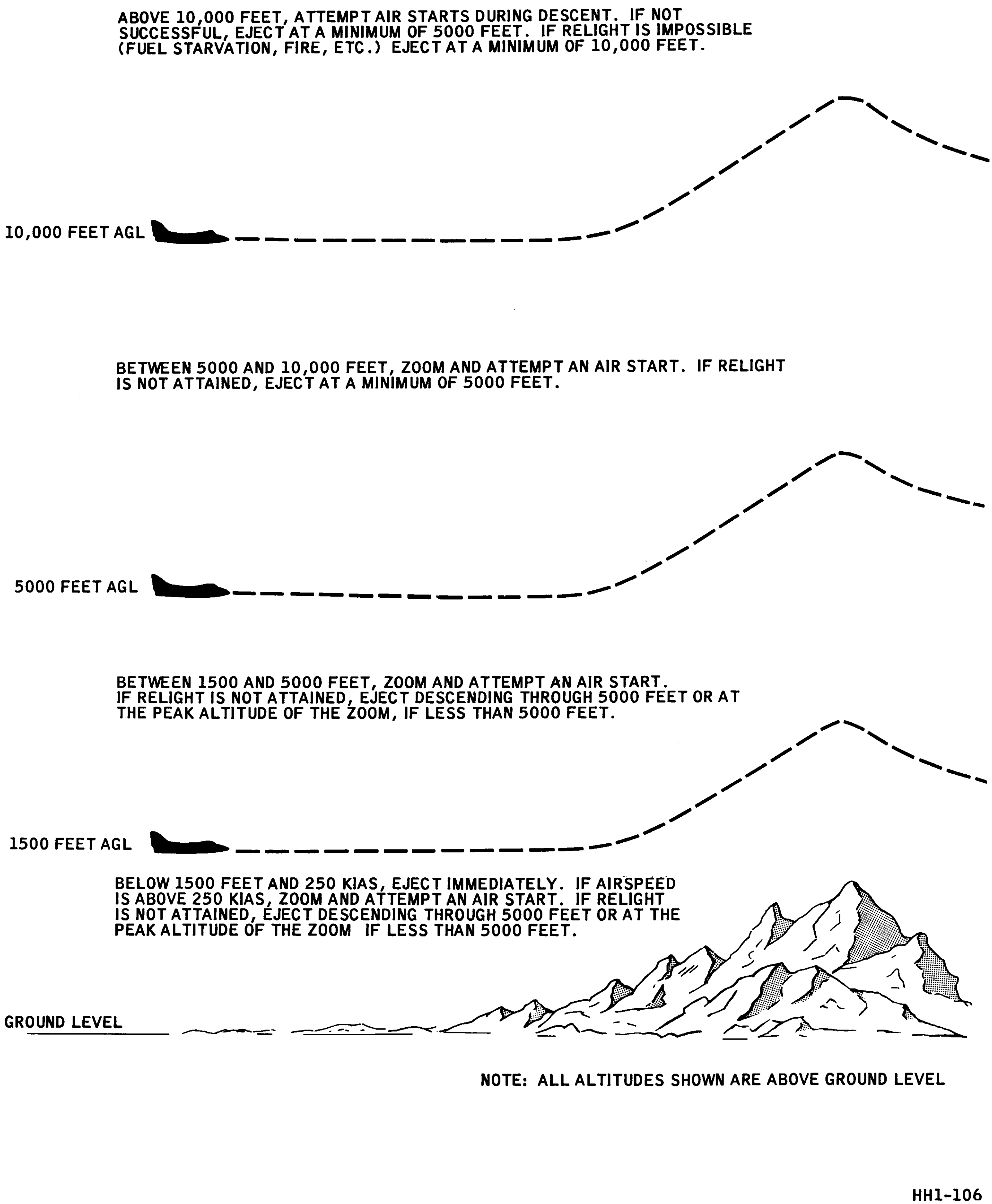


Figure 5-3. Summary of Flameout Action

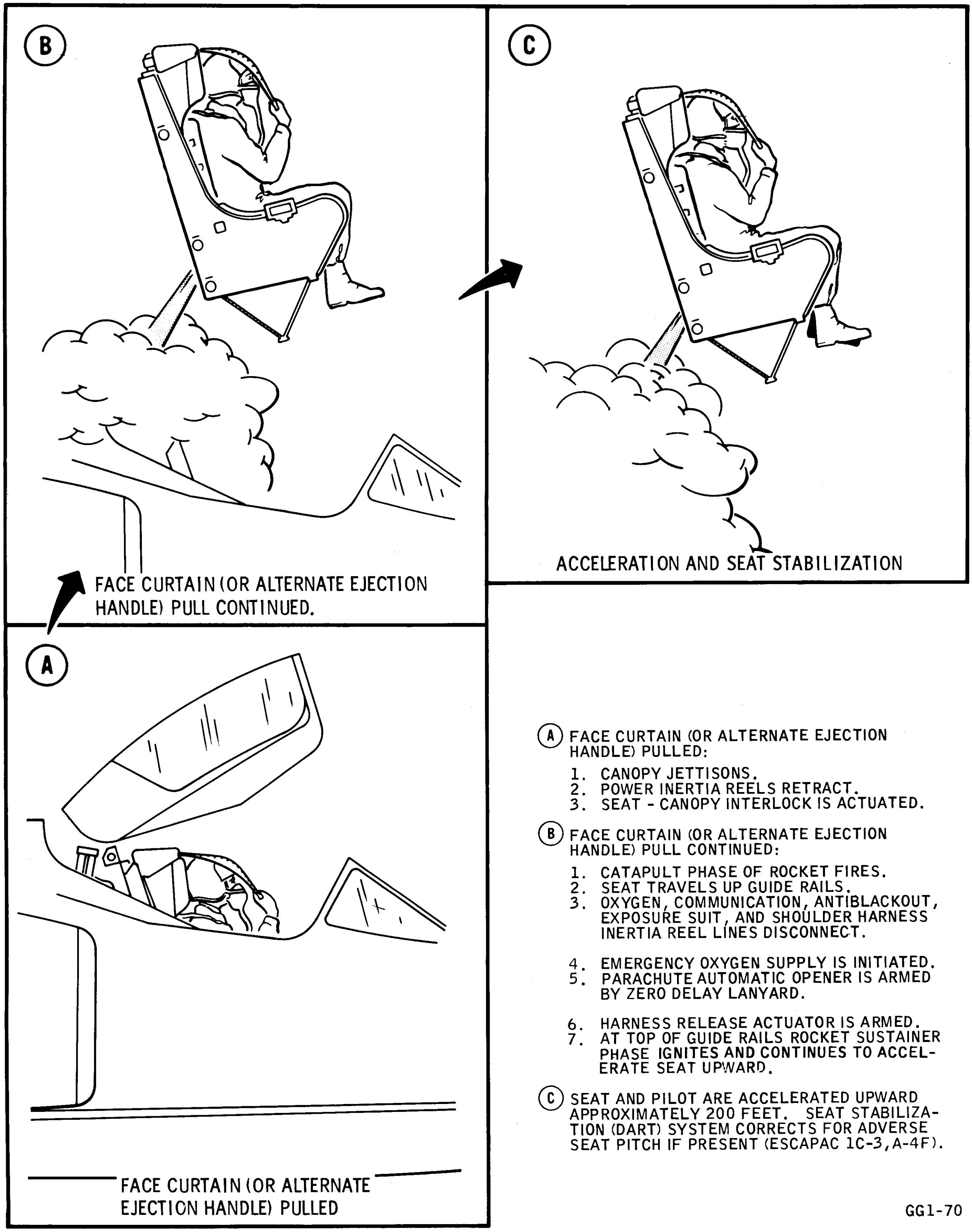
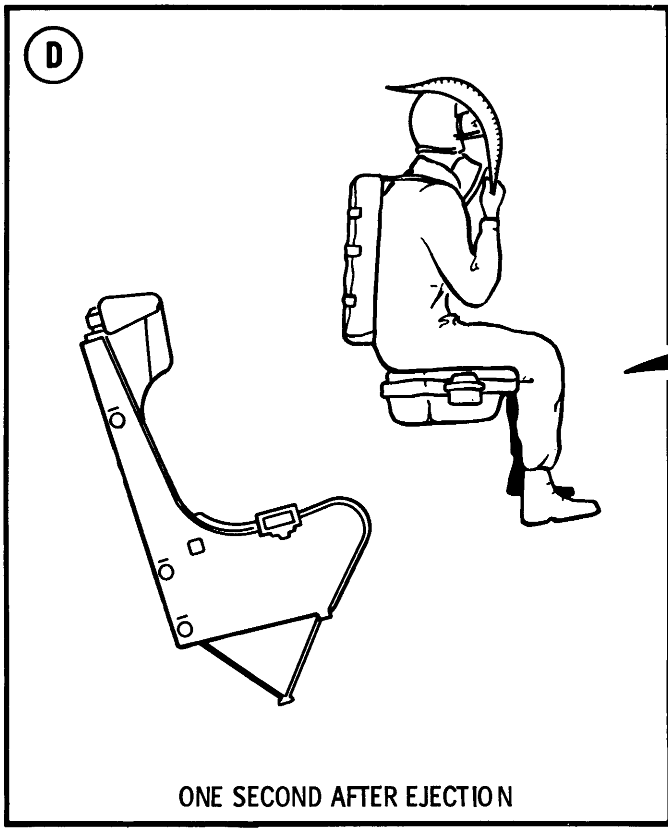
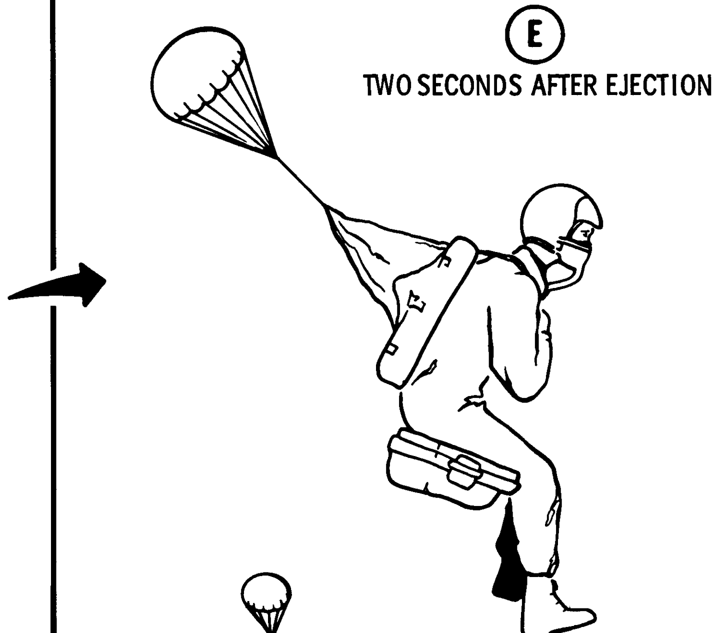
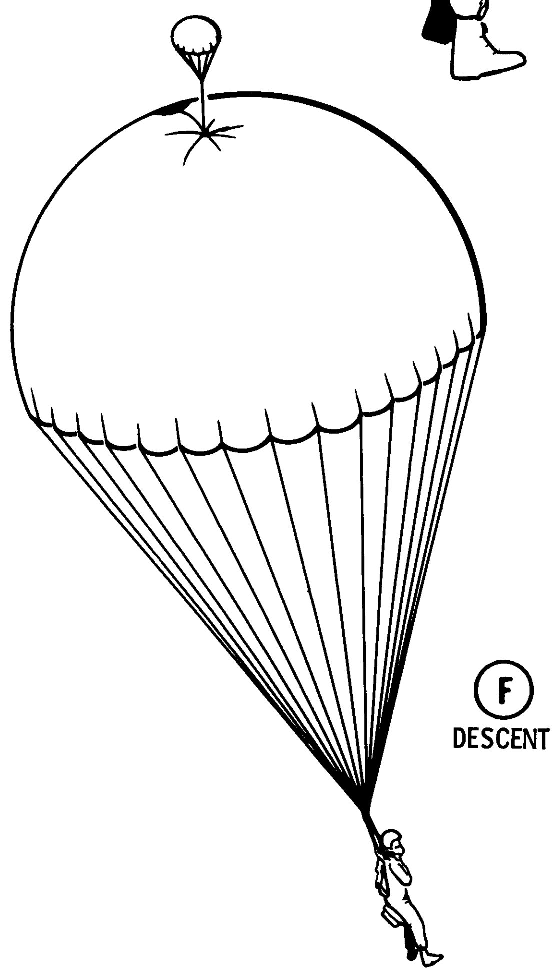


Figure 5-4. Ejection Sequence – ESCAPAC 1 and 1C-3 Ejection Seats (Sheet 1)







(D) ONE SECOND AFTER EJECTION:

1. HARNESS AND SURVIVAL GEAR RELEASE FROM SEAT.
2a. BOTH EJECTION CONTROL HANDLES DISCONNECT FROM SEAT (ESCAPAC 1C-3, A4F)
2b. EJECTION CONTROL HANDLE DISCONNECTS (ESCAPAC 1, A4E).
3. SEPARATION BLADDERS INFLATE.

(E) TWO SECONDS AFTER EJECTION:

1a. PARACHUTE BEGINS TO DEPLOY (IF BELOW 14,000 FEET) (ESCAPAC-1C-3,A4F).
1b. BELOW 14,000 FEET FULL PARACHUTE BLOSSOMING MAY REQUIRE 1 TO 4 SECONDS DEPENDING ON AIRSPEED. (ZERO DELAY NOT INSTALLED, ESCAPAC 1, A4E)

(F) DESCENT

1. REMOVE OXYGEN MASK AND DISCONNECT OXYGEN/RADIO HOSE BELOW 10,000 FEET BUT BEFORE CONTACT.
2. PULL SEATPACK RELEASE HANDLE TO DEPLOY LIFERAFT. LIFERAFT WILL INFLATE AND SUSPEND FROM A 20-FOOT LINE.

WARNING

DEPLOYING RSSK-8 SEAT PACK IS NOT RECOMENDED OVER HEAVILY WOODED AREA.

GG1-58

Figure 5-4. Ejection Sequence – ESCAPAC 1 and 1C-3 Ejection Seats (Sheet 2)

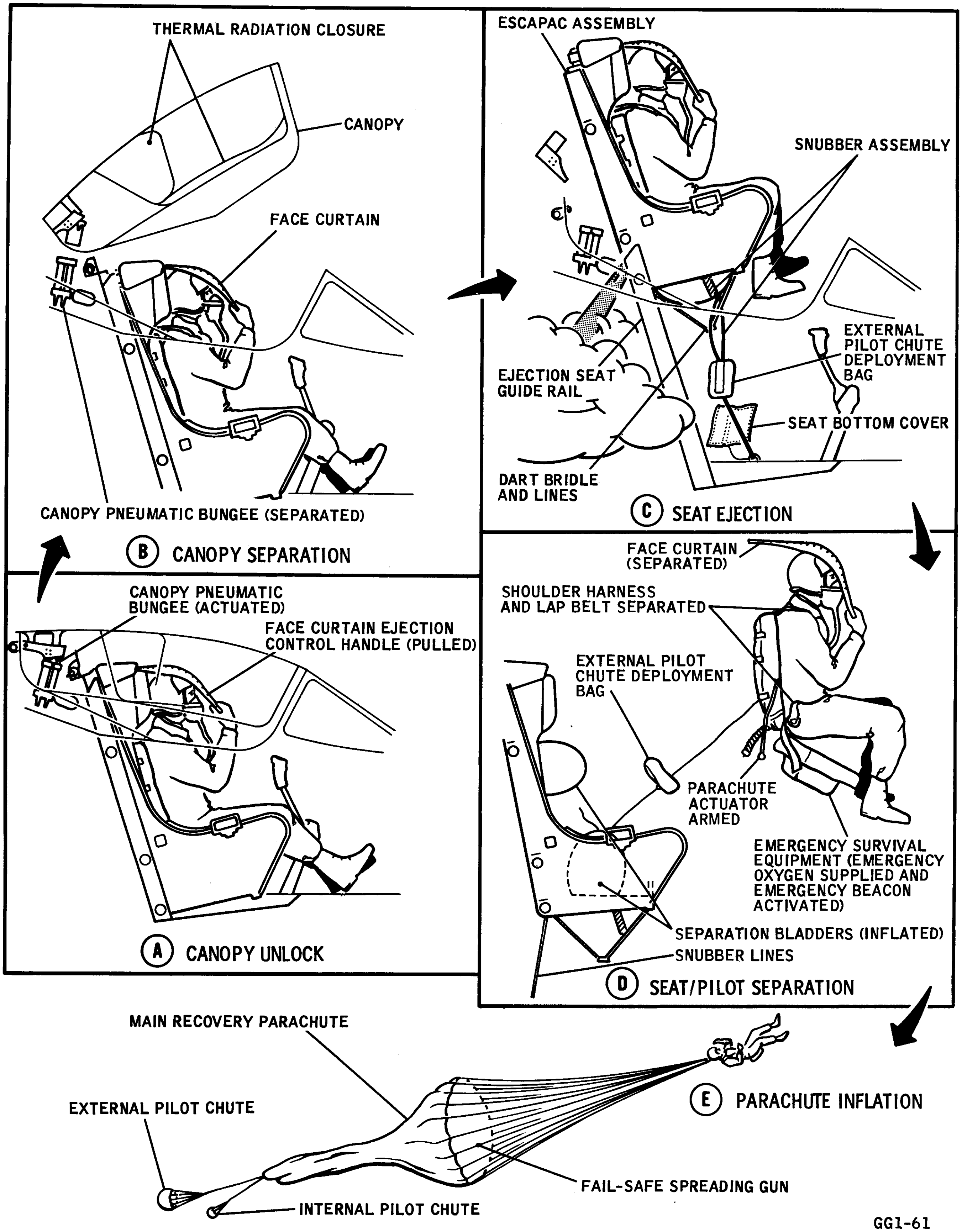


Figure 5-5. Zero-Zero Ejection Seat Sequence

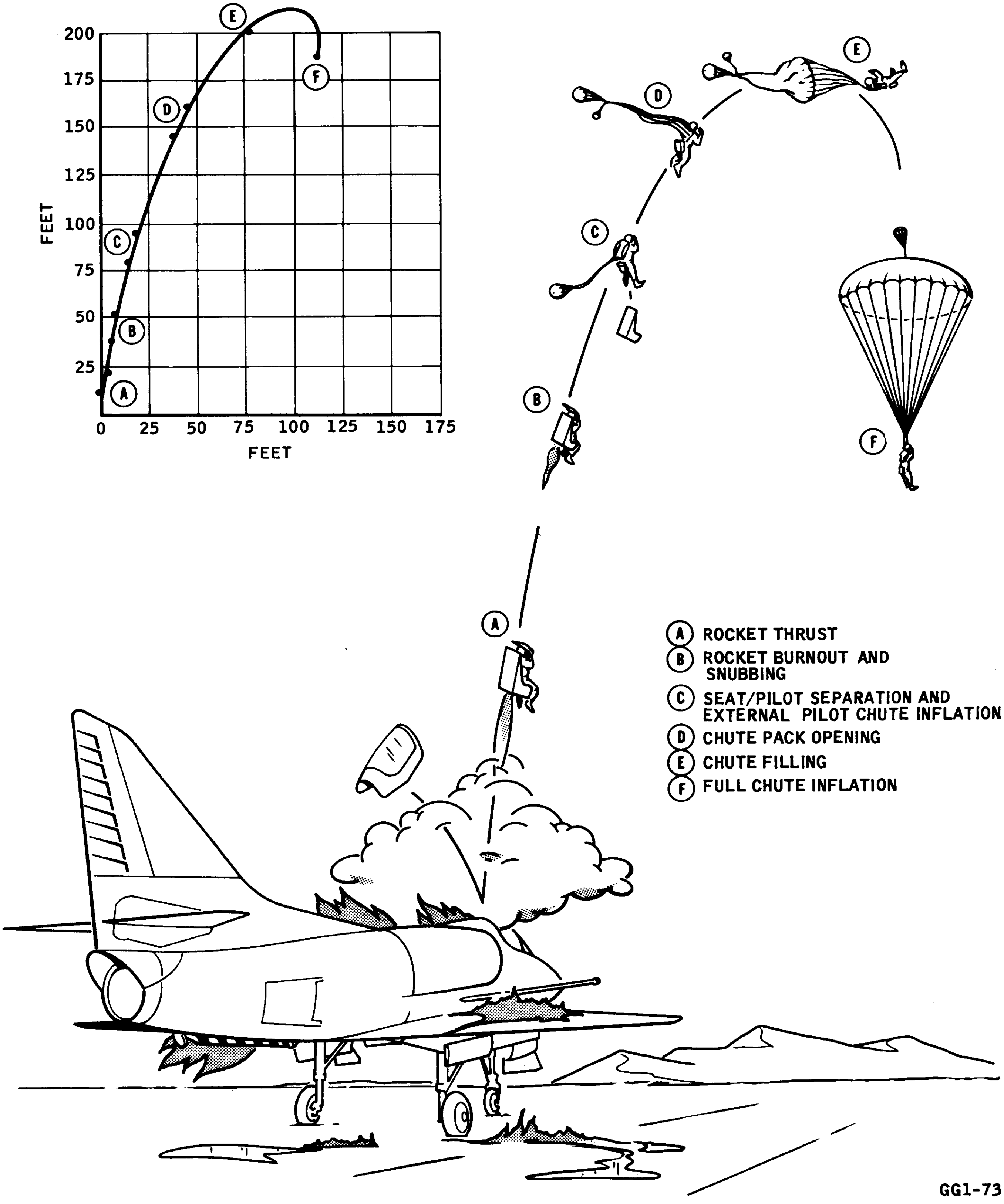
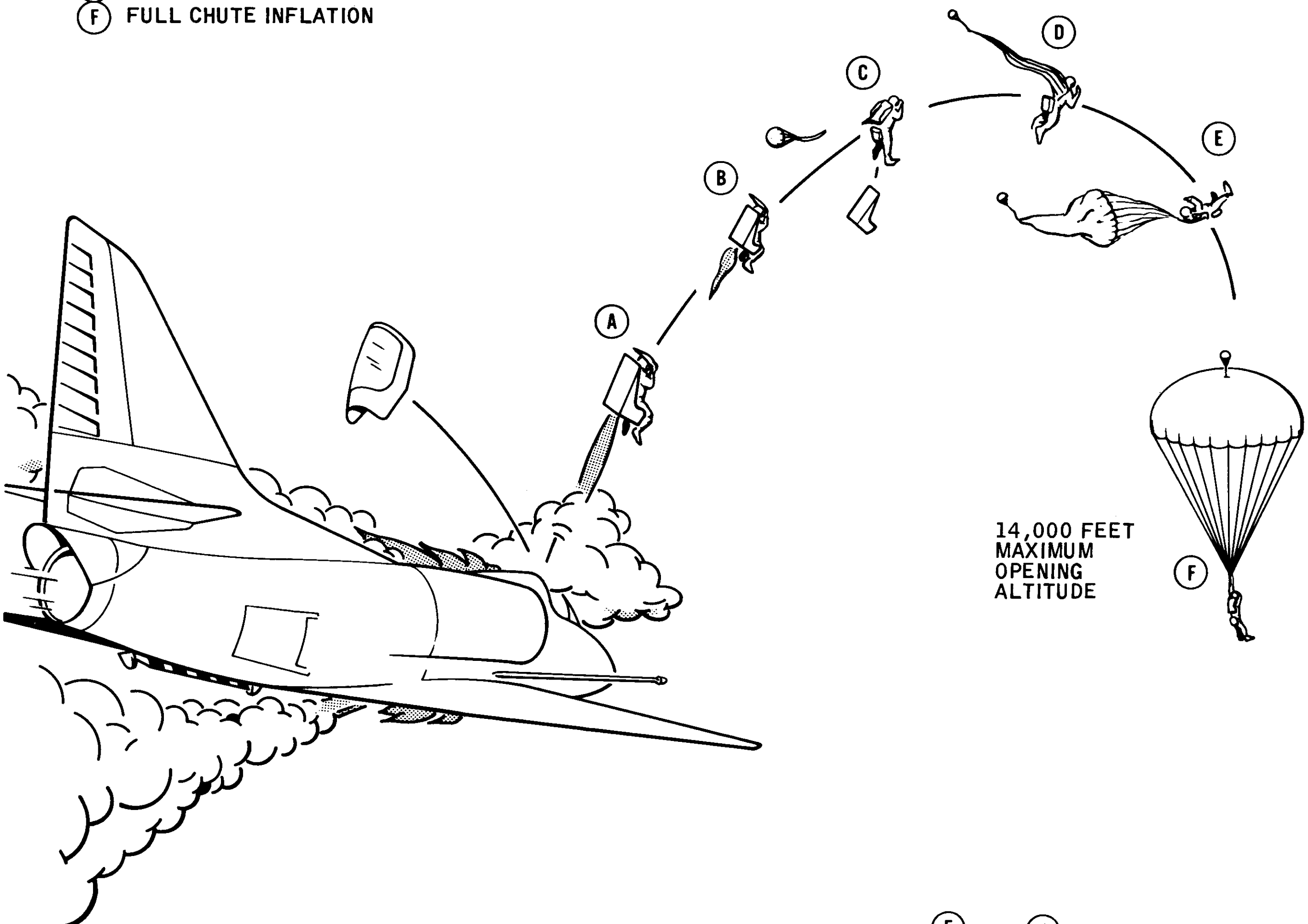


Figure 5-6. Zero-Zero Ejection Seat — 0-Knot Trajectory



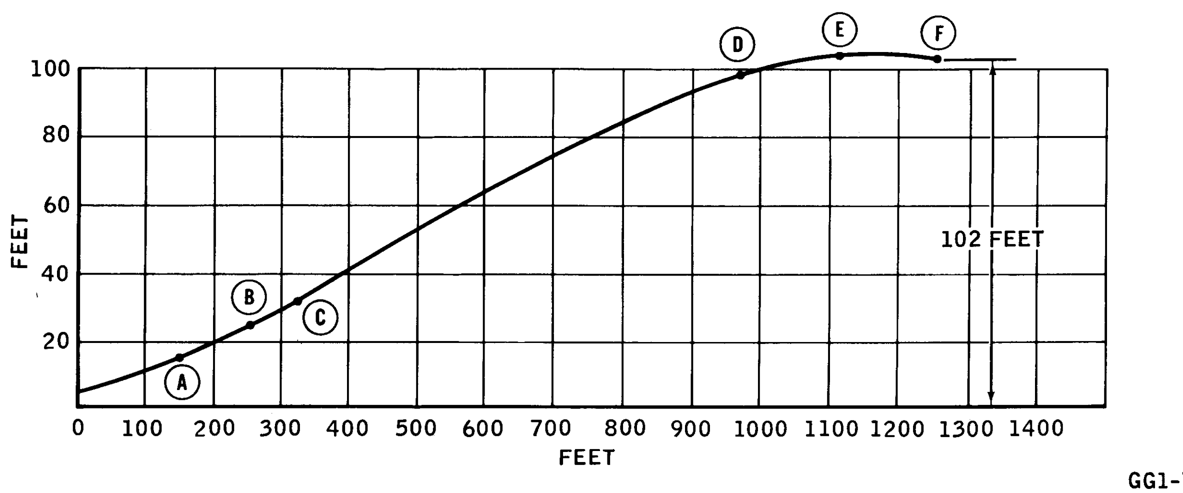
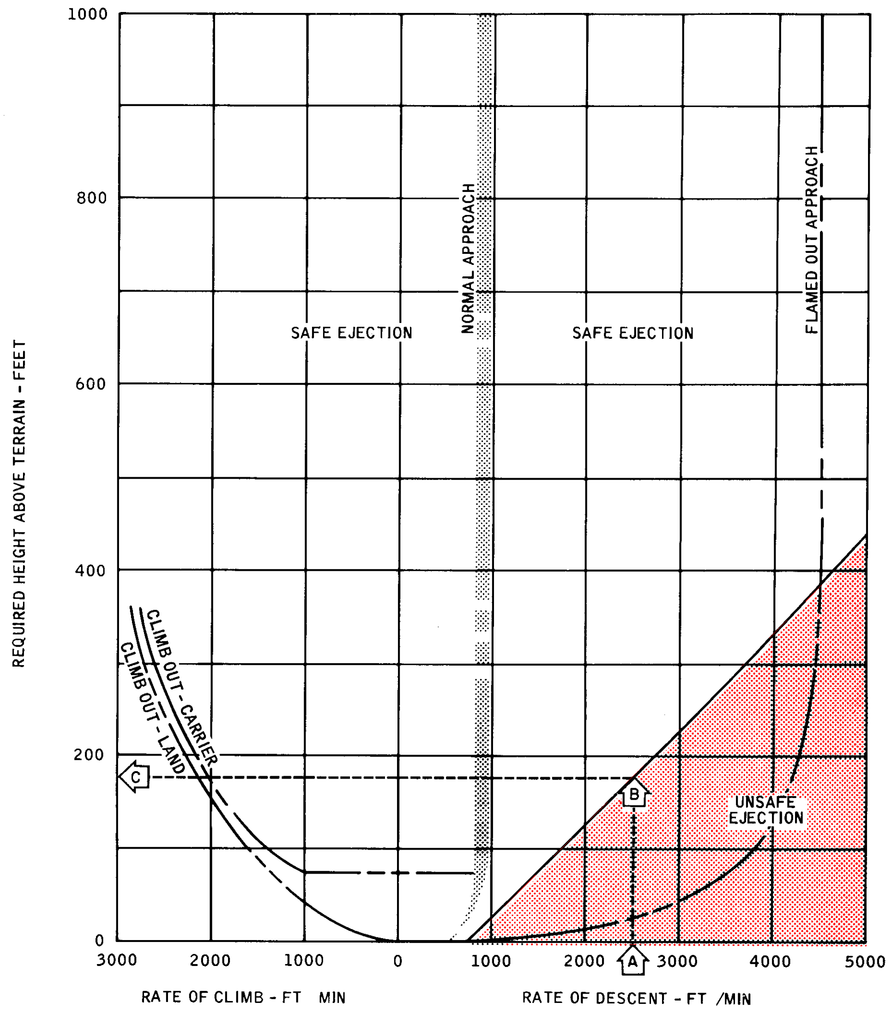


Figure 5-7. Zero-Zero Ejection Seat — 600-Knot Trajectory

TERRAIN CLEARANCE FOR SAFE EJECTION
ESCAPAC 1 ROCKET SEAT WITH
ZERO DELAY LANYARD



REMARKS:

1. Curves labeled Climb Out, Normal Approach, and Flamed Out Approach are typical curves shown for reference only. Do not use them to read height for safe ejection.
2. Ejection capability curve (Safe-Unsafe Ejection region boundary) is based on:
   a. 2-second pilot reaction time (except climbing cases).
   b. Normal aircraft pitch $\pm 15^{\circ}$ for conditions shown.
   c. Nominal parachute opening delay time and parachute deployment.
3. These curves are based on the best data available at time of publication, and are valid only for conditions indicated.

EXAMPLE:

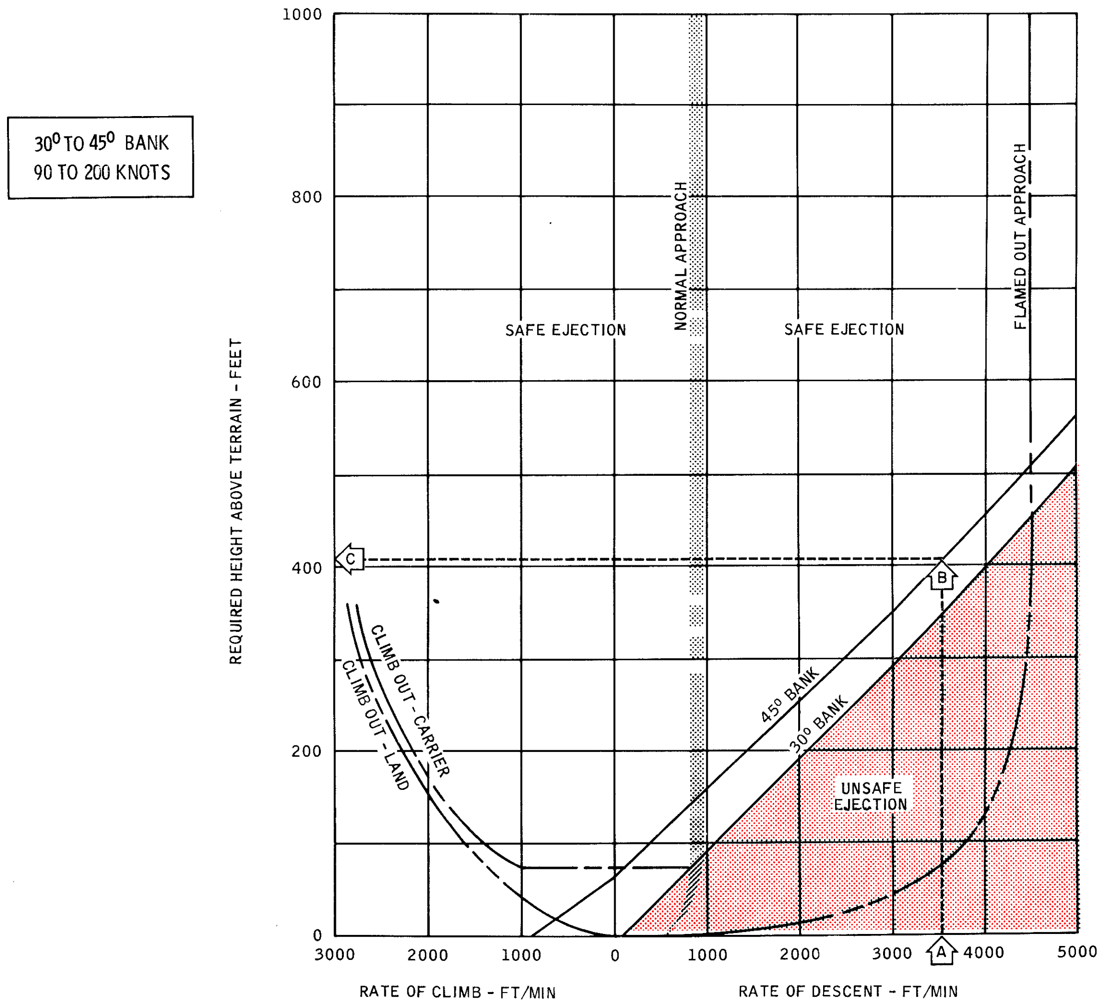
To find minimum height above terrain for safe ejection at a rate of descent of 2500 ft/min.

1. Enter chart at 2500 ft/min rate of descent. A
2. Follow vertically upward to ejection capability curve. B
3. Read horizontally 180 feet minimum height above terrain. C

DATA AS OF: 6 January 1965
DATA BASIS: Computer Calculations

Figure 5-8. Terrain Clearance for Safe Ejection (Sheet 1)

TERRAIN CLEARANCE FOR SAFE EJECTION
ESCAPAC 1 ROCKET SEAT WITH
ZERO DELAY LANYARD



REMARKS:

1. Curves labeled Climb Out, Normal Approach, and Flamed Out Approach are typical curves shown for reference only. Do not use them to read height for safe ejection.
2. Ejection capability curve (Safe-Unsafe Ejection region boundary) is based on:
   a. 2-second pilot reaction time (except climbing cases).
   b. Normal aircraft pitch $\pm 15°$ for conditions shown.
   c. Nominal parachute opening delay time and parachute deployment.
3. These curves are based on the best data available at time of publication, and are valid only for conditions indicated.

EXAMPLE:

To find minimum height above terrain for safe ejection at a rate of descent of 3500 ft/min and a bank angle of 45 degrees:

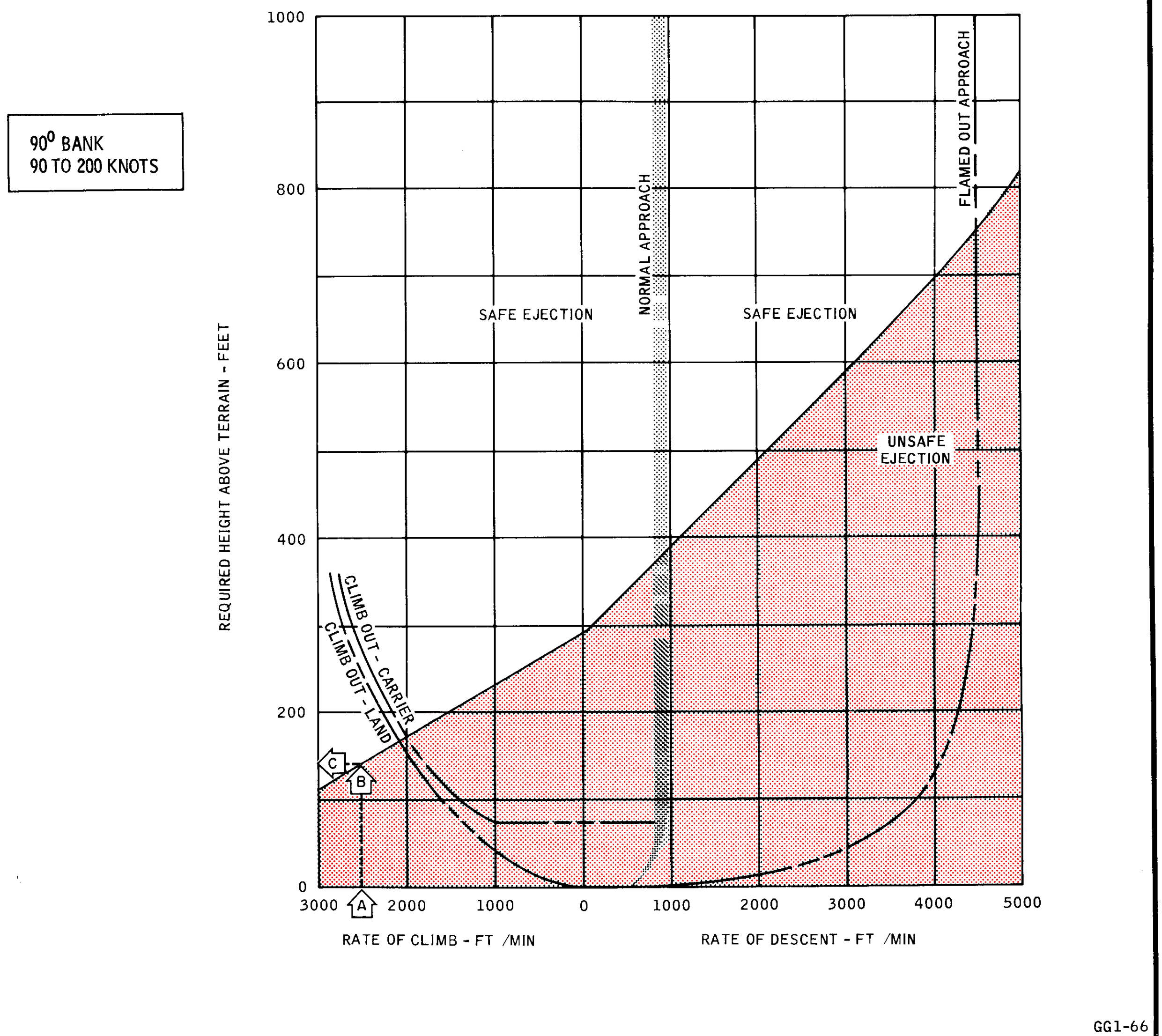
1. Enter chart at 3500 ft/min. rate of descent. A
2. Follow vertically upward to ejection capability curve for 45° bank. B
3. Read horizontally 405 feet minimum height above terrain. C

DATA AS OF: 6 January 1965

DATA BASIS: Computer Calculations

Figure 5-8. Terrain Clearance for Safe Ejection (Sheet 2)

TERRAIN CLEARANCE FOR SAFE EJECTION
ESCAPAC 1 ROCKET SEAT WITH
ZERO DELAY LANYARD



REMARKS:

1. Curves labeled Climb Out, Normal Approach, and Flamed Out Approach are typical curves shown for reference only. Do not use them to read height for safe ejection.
2. Ejection capability curve (Safe-Unsafe Ejection region boundary) is based on:
   a. 2-second pilot reaction time (except climbing cases).
   b. Normal aircraft pitch $\pm 15^{\circ}$ for conditions shown.
   c. Nominal parachute opening delay time and parachute deployment.
3. To obtain height for safe ejection in inverted flight, add 300 feet to the height shown for 90° bank.
4. These curves are based on the best data available at time of publication, and are valid only for conditions indicated.

DATA AS OF: 6 January 1965
DATA BASIS: Computer Calculations

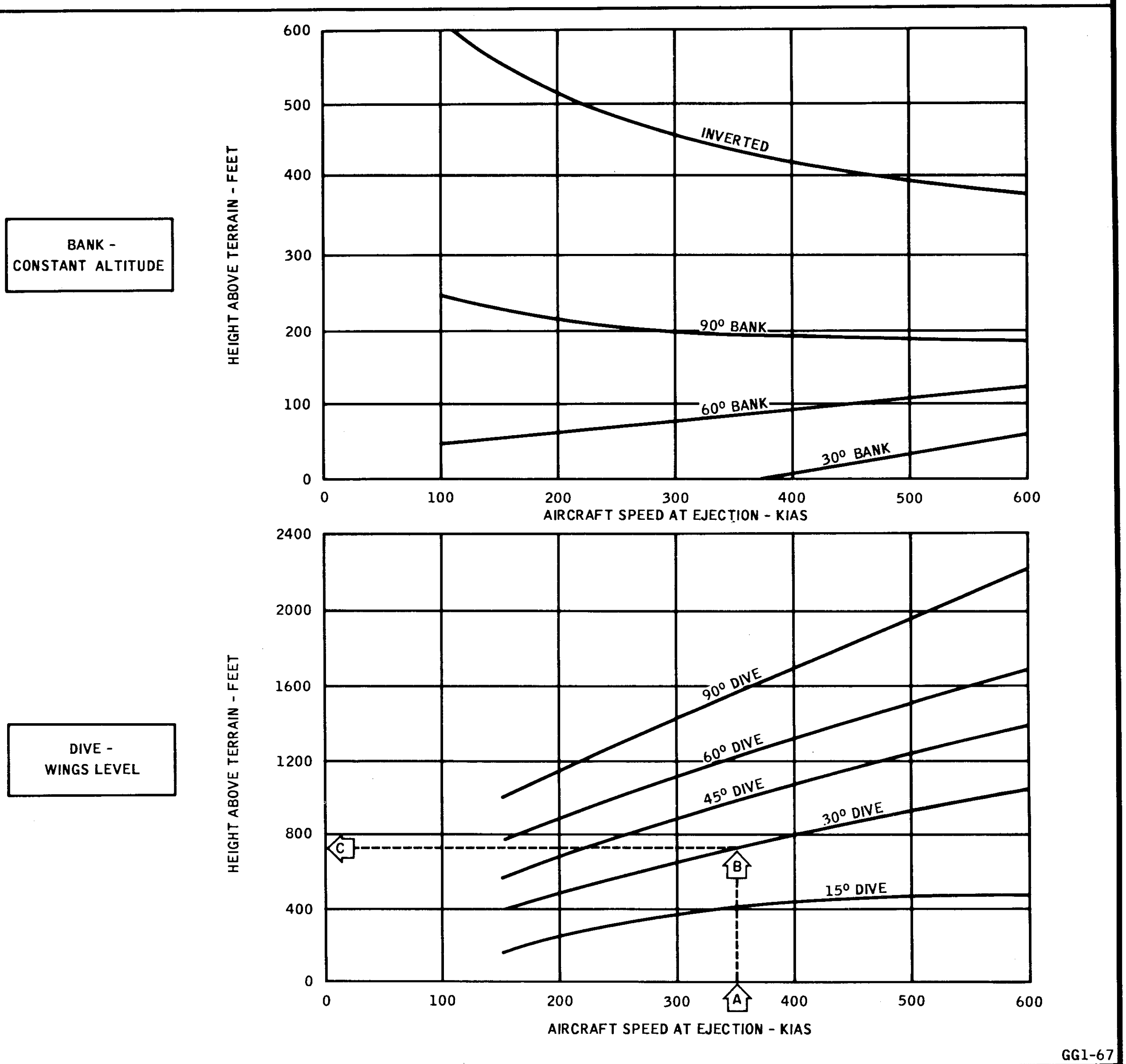
EXAMPLE:

To find minimum height above terrain for safe ejection at a rate of descent of 2500 ft/min.

1. Enter chart at 2500 ft/min rate of climb. (A)
2. Follow vertically upward to ejection capability curve. (B)
3. Read horizontally 140 feet minimum height above terrain. (C)

Figure 5-8. Terrain Clearance for Safe Ejection (Sheet 3)

TERRAIN CLEARANCE FOR SAFE EJECTION
ESCAPAC 1 ROCKET SEAT WITH
ZERO DELAY LANYARD



REMARKS:
1. These curves do not include pilot's reaction time or safety factor.
2. These curves are based on the best data available at time of publication, and are valid only for conditions indicated.

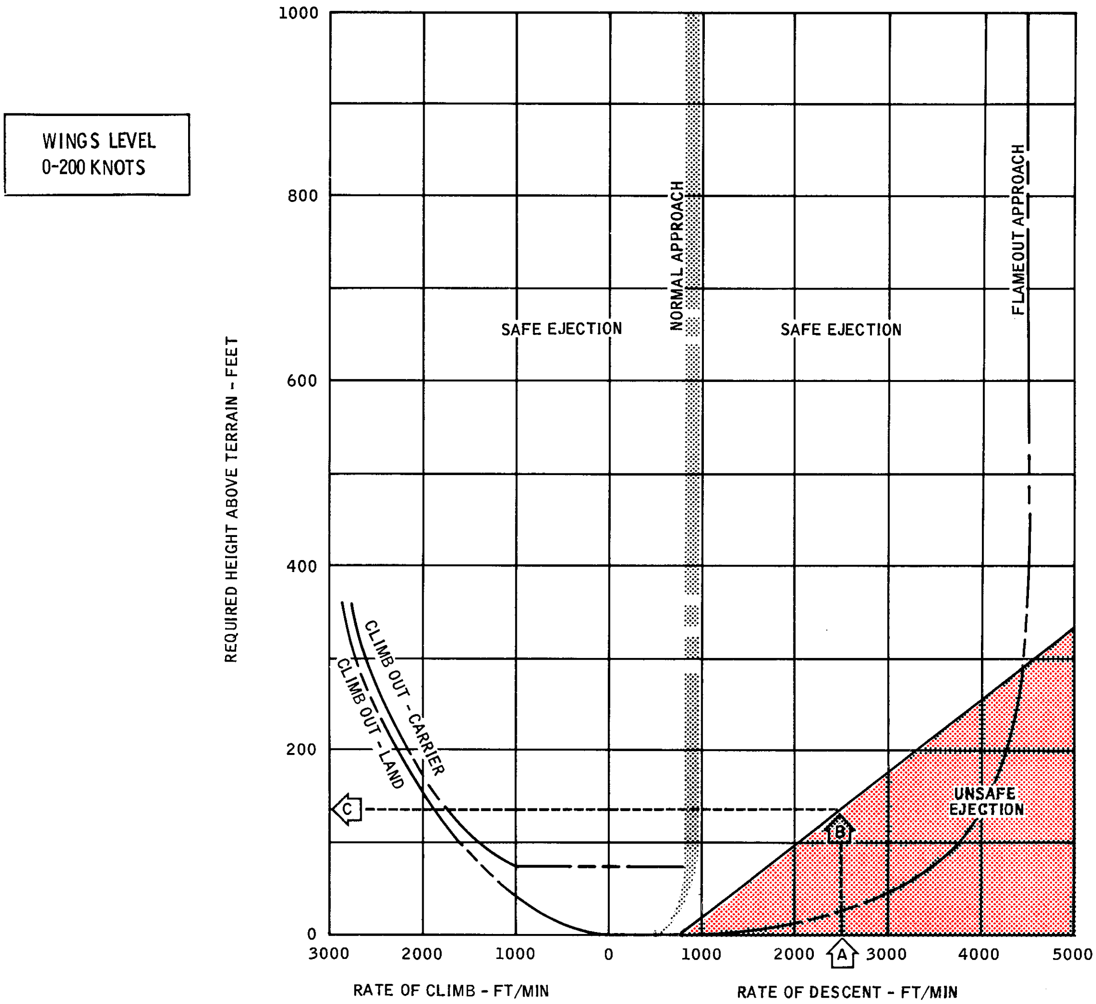
EXAMPLE:
1. Enter dive (wings level) chart at 350 KIAS. A
2. Follow vertically upward to 30° dive curve. B
3. Read horizontally 750 feet minimum height above terrain. C

DATA AS OF: 6 January 1965

DATA BASIS: Calculations

Figure 5-8. Terrain Clearance for Safe Ejection (Sheet 4)

TERRAIN CLEARANCE FOR SAFE EJECTION
ESCAPAC IC-3 EJECTION SEAT



REMARKS:

1. Curves labeled Climb Out, Normal Approach, and Flame-out Approach are typical curves shown for reference only. Do not use curves to read height for safe ejection.
2. Ejection capability curve (Safe-Unsafe Ejection region boundary) is based on:
   a. 2-second pilot reaction time (except climbing cases).
   b. Normal aircraft pitch $\pm 15^{\circ}$ for conditions shown.
   c. Nominal parachute opening delay time and parachute deployment.
   d. 50-foot recovery height safety factor.
3. These curves are based on the best data available at time of publication, and are valid only for conditions indicated.

DATA AS OF: 1 October 1966

DATA BASIS: Computer Calculations

EXAMPLE:

To find minimum height above terrain for safe ejection at a rate of descent of 2500 ft/min.

1. Enter chart at 2500 ft/min rate of descent. A
2. Follow vertically upward to ejection capability curve. B
3. Read horizontally 136 feet minimum height above terrain. C

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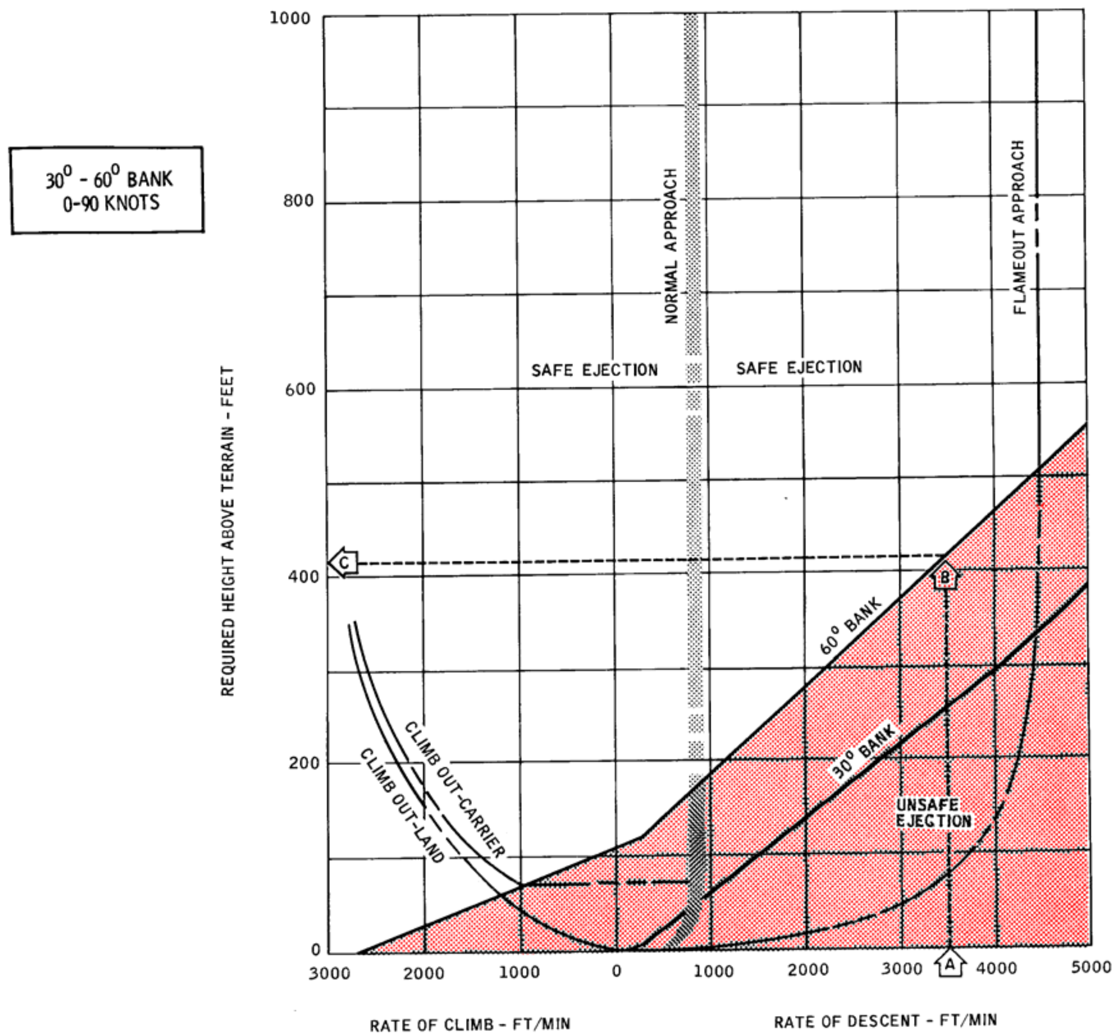
Figure 5-8 Terrain Clearance for Safe Ejection (Sheet 5)

TERRAIN CLEARANCE FOR SAFE EJECTION
ESCAPAC IC-3 EJECTION SEAT



REMARKS:

1. Curves labeled Climb Out, Normal Approach, and Flame-out Approach are typical curves shown for reference only. Do not use curves to read height for safe ejection.
2. Ejection capability curve (Safe-Unsafe Ejection region boundary) is based on:
   a. 2-second pilot reaction time (except climbing cases).
   b. Normal aircraft pitch + 15° for conditions shown.
   c. Nominal parachute opening delay time and parachute deployment.
   d. 50-foot recovery height safety factor.
3. These curves are based on the best data available at time of publication, and are valid only for conditions indicated.

EXAMPLE:

To find minimum height above terrain for safe ejection at a rate of descent of 3500 ft/min and a bank angle of 60 degrees:

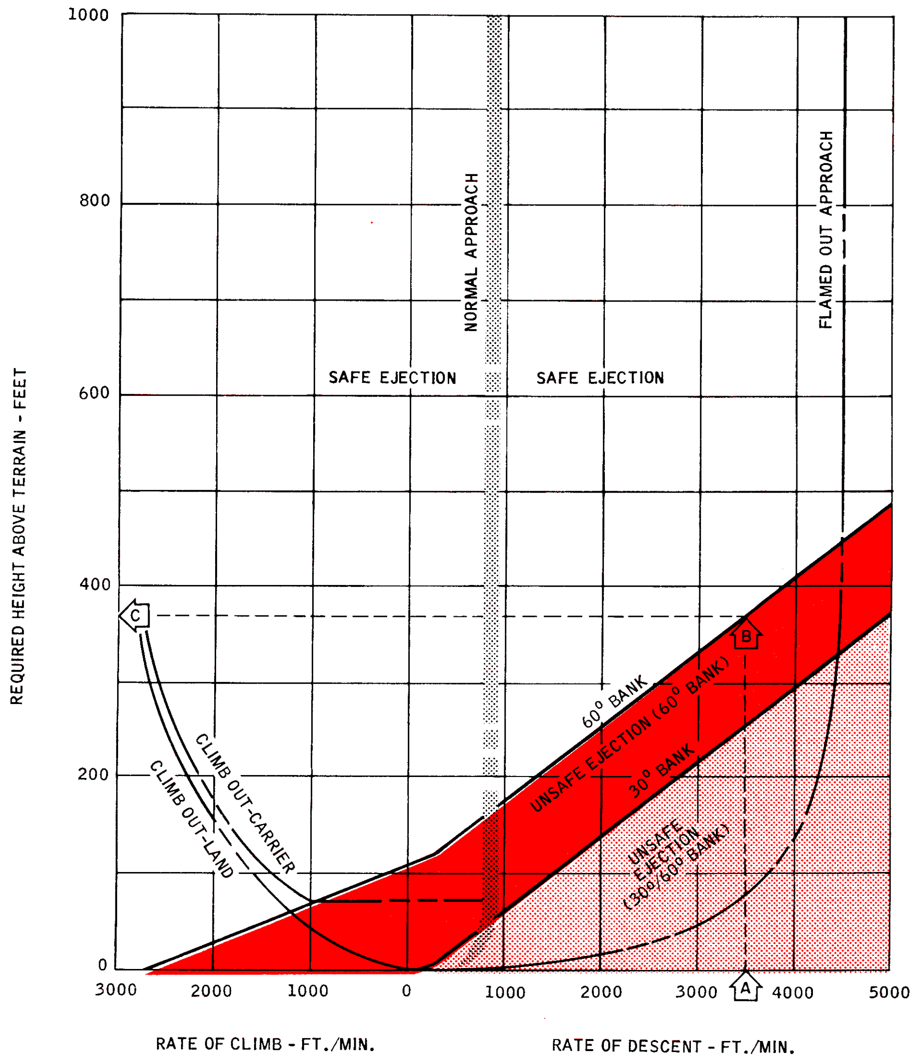
1. Enter chart at 3500 ft/min rate of descent. (A)
2. Follow vertically upward to ejection capability curve for 60° bank. (B)
3. Read horizontally 410 feet minimum height above terrain. (C)

DATA AS OF: 1 October 1966
DATA BASIS: Computer Calculations.

GG1-105

Figure 5-8. Terrain Clearance for Safe Ejection (Sheet 5A)

TERRAIN CLEARANCE FOR SAFE EJECTION
ESCAPAC IC-3 EJECTION SEAT



REMARKS:

1. Curves labeled Climb Out, Normal Approach, And Flamed Out Approach are typical curves shown for reference only. Do not use them to read height for safe ejection.
2. Ejection capability curve (Safe-Unsafe Ejection region boundary) is based on:
   a. 2-second pilot reaction time (except climbing cases).
   b. Normal aircraft pitch ± 15° for conditions shown.
   c. Nominal parachute opening delay time and parachute deployment.
   d. 50-foot recovery height safety factor.
3. These curves are based on the best data available at time of publication, and are valid only for conditions indicated.

DATA AS OF: 1 October 1966
DATA BASIS: Computer Calculations.

EXAMPLE:

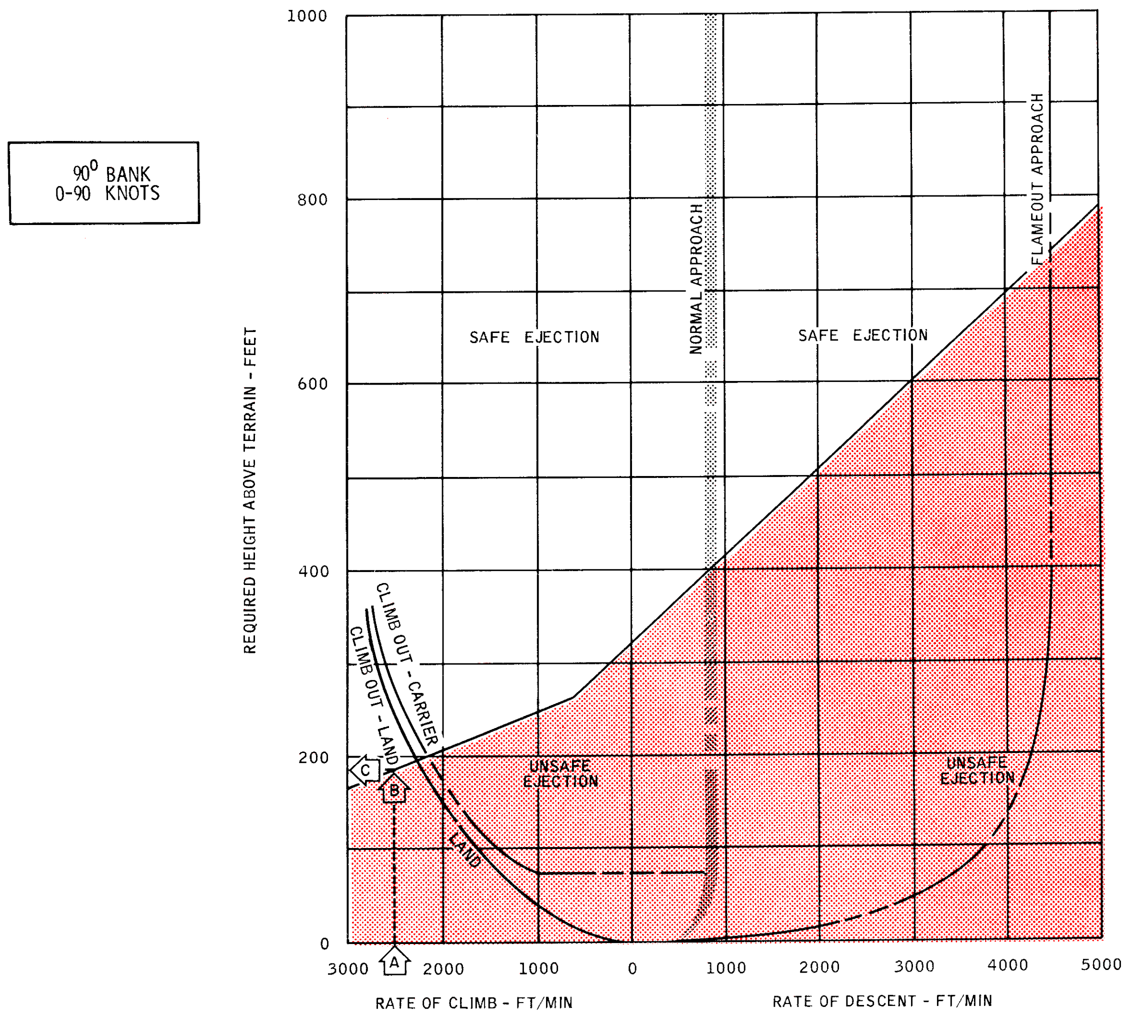
To find minimum height above terrain for safe ejection at a rate of descent of 3500 ft./min. and a bank angle of 60° degrees:

1. Enter chart at 3500 ft./min. rate of descent. A
2. Follow vertically upward to ejection capability curve for 60° bank. B
3. Read horizontally 370 feet minimum height above terrain. C

Figure 5-8. Terrain Clearance for Safe Ejection (Sheet 6)

TERRAIN CLEARANCE FOR SAFE EJECTION

ESCAPAC IC-3 EJECTION SEAT



REMARKS:

1. Curves labeled Climb Out, Normal Approach, and Flameout Approach are typical curves shown for reference only. Do not use curves to read height for safe ejection.
2. Ejection capability curve (Safe-Unsafe Ejection region boundary) is based on:
   a. 2-second pilot reaction time (except climbing cases).
   b. Normal aircraft pitch ±15° for conditions shown.
   c. Nominal parachute opening delay time and parachute deployment.
   d. 50-foot recovery height safety factor.
3. To obtain height for safe ejection in inverted flight, add 300 feet to the height shown for 90° bank.
4. These curves are based on the best data available at time of publication, and are valid only for conditions indicated.

EXAMPLE:

To find minimum height above terrain for safe ejection at a rate of climb of 2500 ft/min, and a bank angle of 90 degrees.

1. Enter chart at 2500 ft/min rate of climb. A
2. Follow vertically upward to ejection capability curve. B
3. Read horizontally 186 feet minimum height above terrain. C

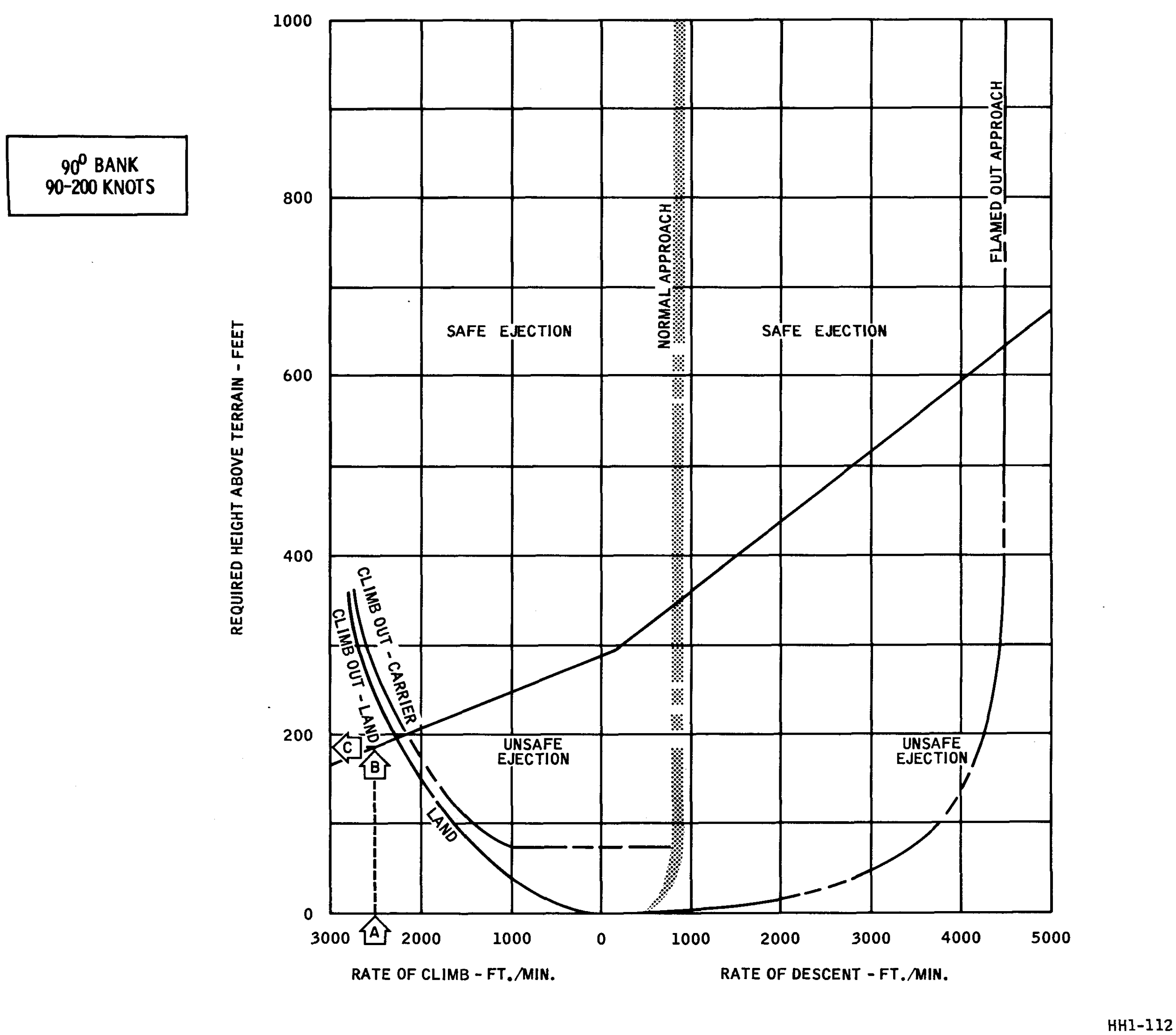
DATA AS OF: 1 October 1966

DATA BASIS: Computer Calculations

GG1-106

Figure 5-8. Terrain Clearance for Safe Ejection (Sheet 6A)

TERRAIN CLEARANCE FOR SAFE EJECTION
ESCAPAC IC-3 EJECTION SEAT



REMARKS:

1. Curves labeled Climb Out, Normal Approach, and Flamed Out Approach are typical curves shown for reference only. Do not use them to read height for safe ejection.
2. Ejection capability curve (Safe-Unsafe Ejection region boundary) is based on:
   a. 2-second pilot reaction time (except climbing cases).
   b. Normal aircraft pitch $\pm 15^\circ$ for conditions shown.
   c. Nominal parachute opening delay time and parachute deployment.
   d. 50-foot recovery height safety factor.
3. To obtain height for safe ejection in inverted flight, add 300 feet to the height shown for 90° bank.
4. These curves are based on the best data available at time of publication, and are valid only for conditions indicated.

DATA AS OF: 1 October 1966

DATA BASIS: Computer Calculations

EXAMPLE:

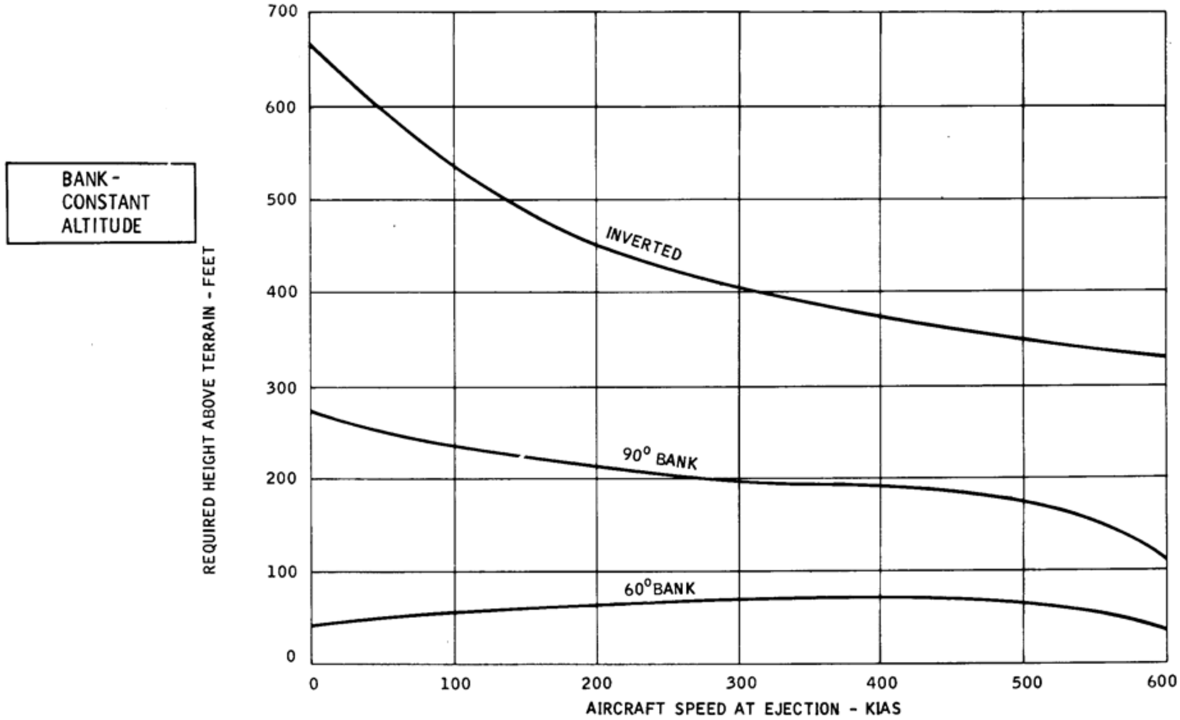
To find minimum height above terrain for safe ejection at a rate of climb of 2500 ft./min., and a bank angle of 90 degrees:

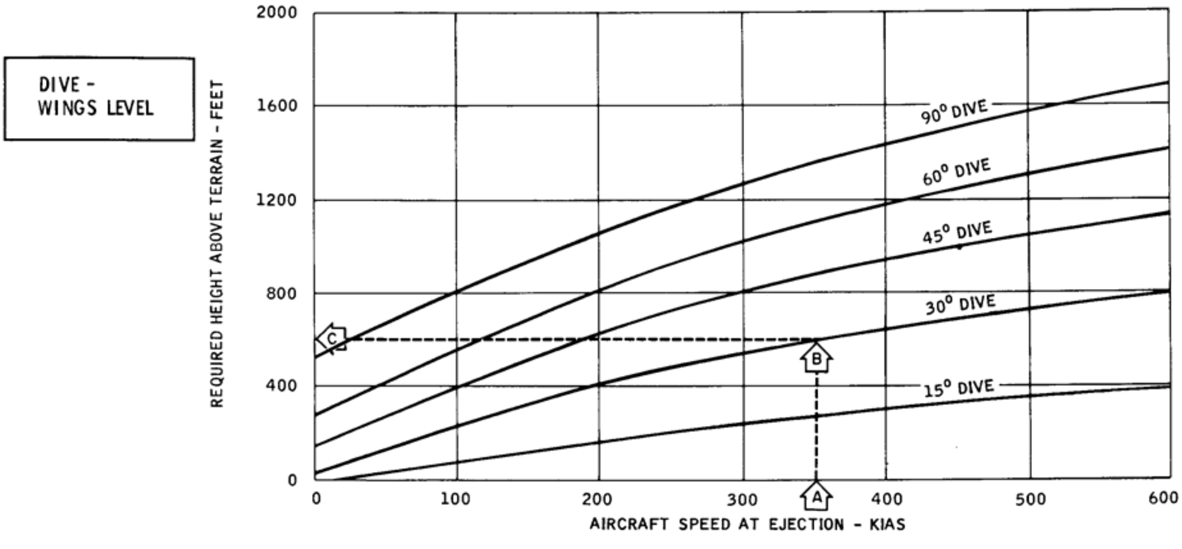
1. Enter chart at 2500 ft./min. rate of climb. A
2. Follow vertically upward to ejection capability curve. B
3. Read horizontally 186 feet minimum height above terrain. C

Figure 5-8. Terrain Clearance for Safe Ejection (Sheet 7)

TERRAIN CLEARANCE FOR SAFE EJECTION

ESCAPAC IC-3 EJECTION SEAT





REMARKS:

1. These curves do not include pilot's reaction time or safety factor.
2. These curves are based on the best data available at time of publication, and are valid only for conditions indicated.

DATA AS OF: 1 October 1966

DATA BASIS: Computer Calculations

EXAMPLE:

1. Enter dive (wings level) chart at 350 KIAS. A
2. Follow vertically upward to 30° dive curve. B
3. Read horizontally 600 feet minimum height above terrain. C

GG1-107

Figure 5-8. Terrain Clearance for Safe Ejection (Sheet 8)

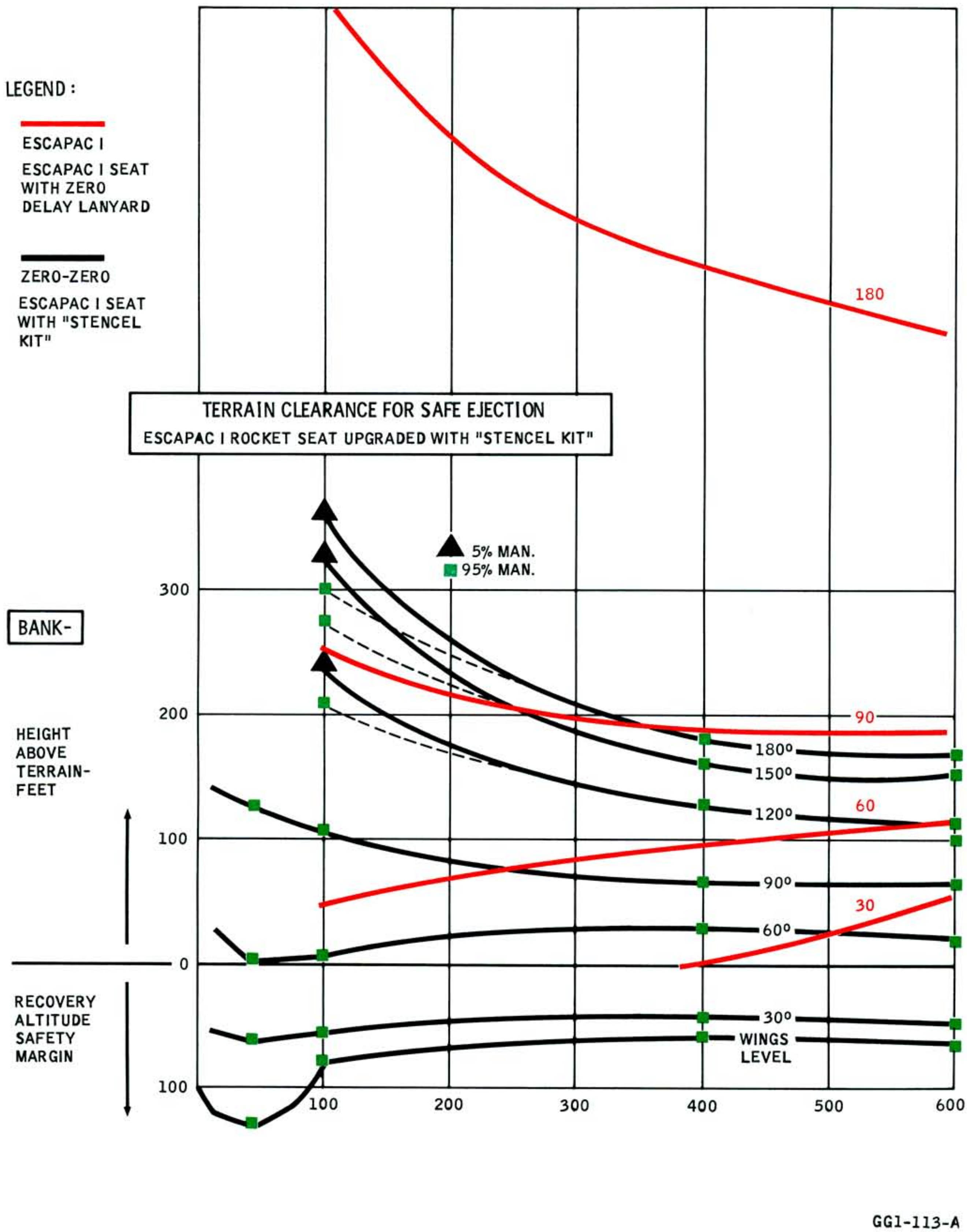
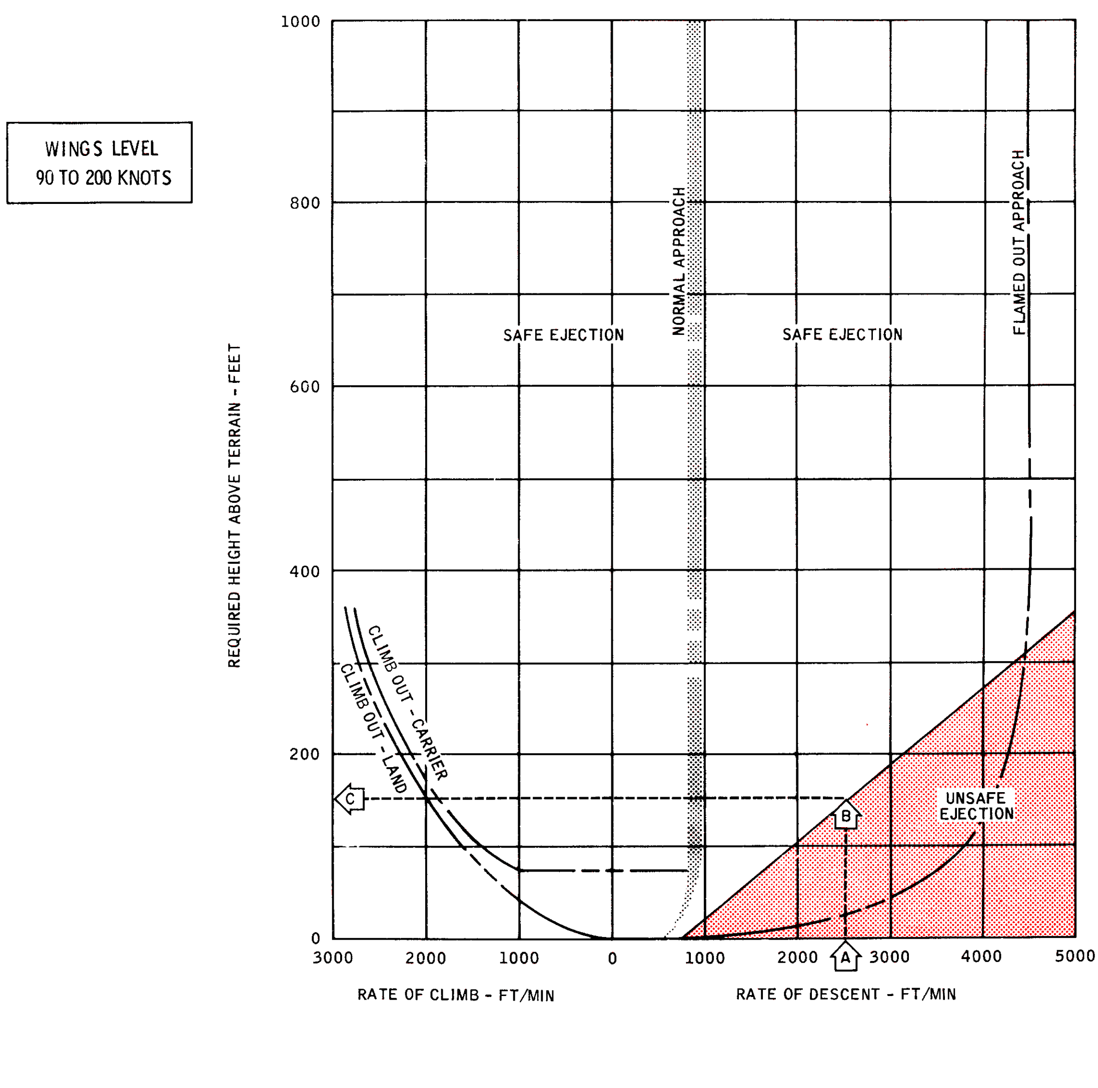


Figure 5-8. Terrain Clearance for Safe Ejection (Sheet 8A)

TERRAIN CLEARANCE FOR SAFE EJECTION
ZERO - ZERO EJECTION SEAT



REMARKS:

1. Curves labeled Climb Out, Normal Approach, and Flamed Out Approach are typical curves shown for reference only. Do not use them to read height for safe ejection.
2. Ejection capability curve (Safe-Unsafe Ejection region boundary) is based on:
   a. 2-second pilot reaction time (except climbing cases).
   b. Normal aircraft pitch $\pm 15^{\circ}$ for conditions shown.
   c. Nominal parachute opening delay time and parachute deployment.
3. These curves are based on the best data available at time of publication, and are valid only for conditions indicated.

EXAMPLE:

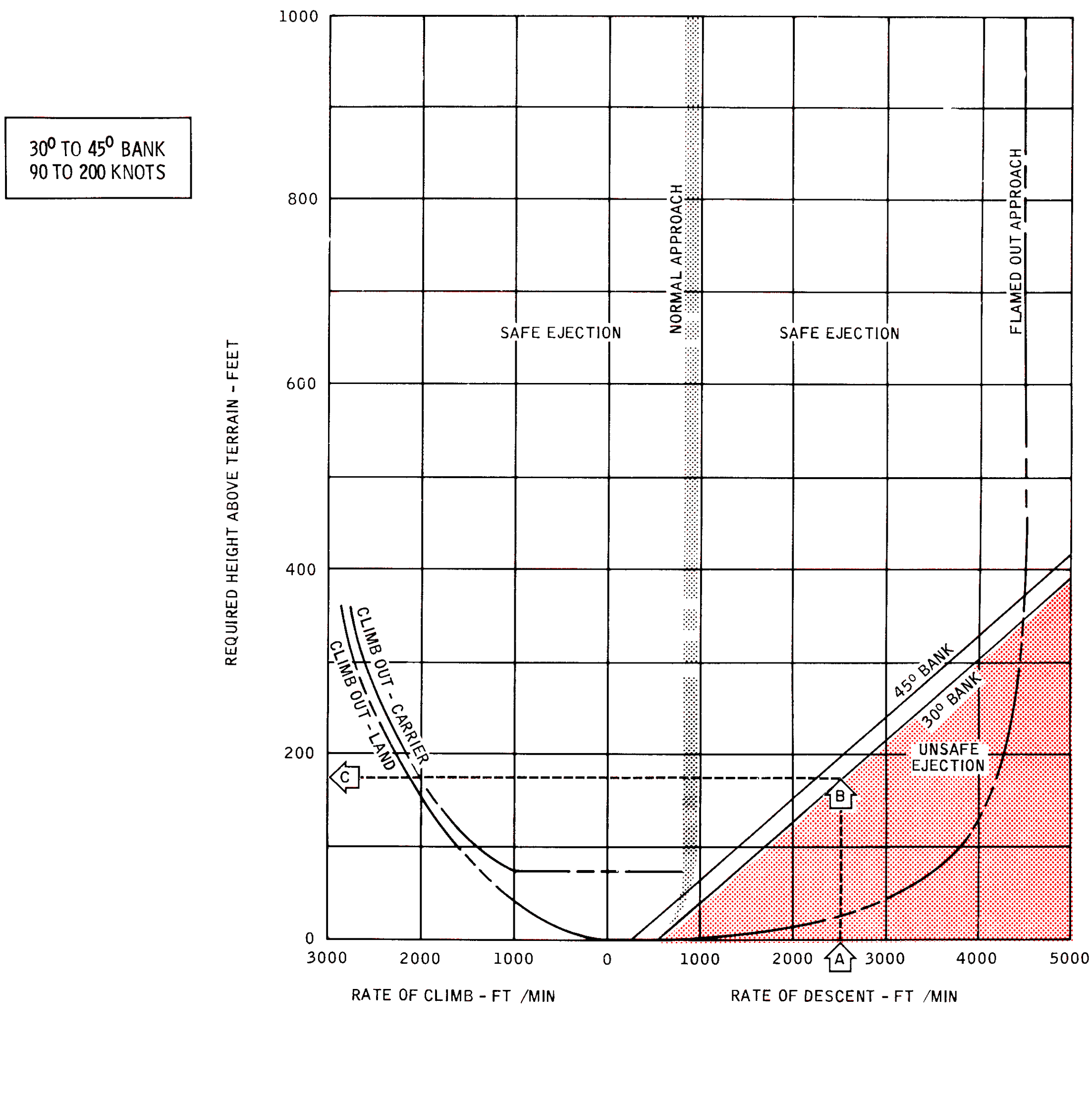
To find minimum height above terrain for safe ejection at a rate of descent of 2500 ft/min.

1. Enter chart at 2500 ft/min. rate of descent. A
2. Follow vertically upward to ejection capability curve. B
3. Read horizontally 150 feet minimum height above terrain. C

DATA AS OF: 2 January 1968
DATA BASIS: Test Results

Figure 5-8. Terrain Clearance for Safe Ejection (Sheet 9)

TERRAIN CLEARANCE FOR SAFE EJECTION
ZERO - ZERO EJECTION SEAT



REMARKS:

1. Curves labeled Climb Out, Normal Approach, and Flamed Out Approach are typical curves shown for reference only. Do not use them to read height for safe ejection.
2. Ejection capability curve (Safe-Unsafe Ejection region boundary) is based on:
   a. 2-second pilot reaction time (except climbing cases).
   b. Normal aircraft pitch ±15° for conditions shown.
   c. Nominal parachute opening delay time and parachute deployment.
3. These curves are based on the best data available at time of publication, and are valid only for conditions indicated.

EXAMPLE:

To find minimum height above terrain for safe ejection at a rate of descent of 2500 ft/min.

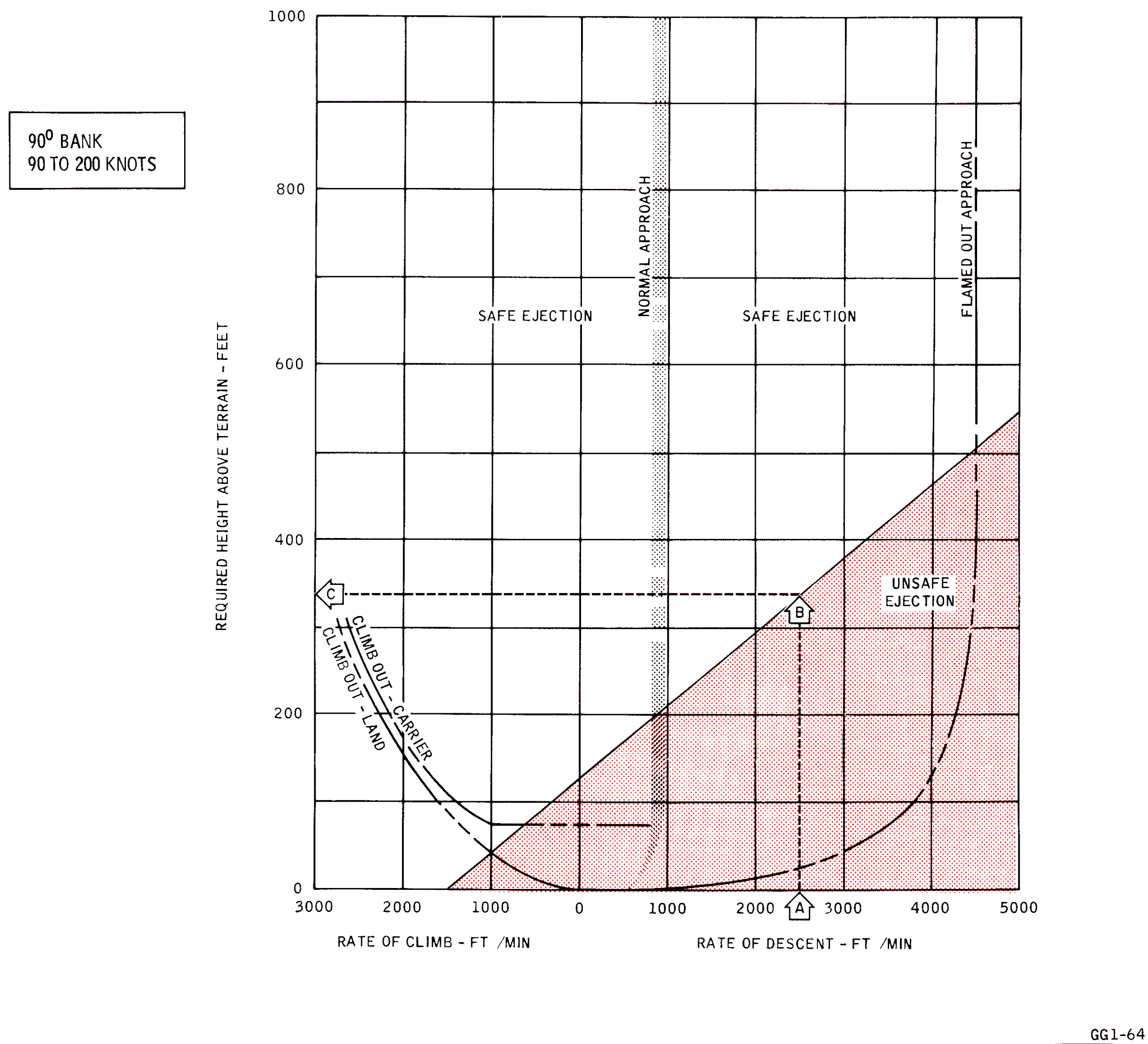
1. Enter chart at 2500 ft/min rate of descent. A
2. Follow vertically upward to ejection capability curve. B
3. Read horizontally 180 feet minimum height above terrain. C

DATA AS OF: 1 January 1968
DATA BASIS: Test results

Figure 5-8. Terrain Clearance for Safe Ejection (Sheet 10)

TERRAIN CLEARANCE FOR SAFE EJECTION

ZERO - ZERO EJECTION SEAT



REMARKS:

1. Curves labeled Climb Out, Normal Approach, and Flamed Out Approach are typical curves shown for reference only. Do not use them to read height for safe ejection.
2. Ejection capability curve (Safe-Unsafe Ejection region boundary) is based on:
   a. 2-second pilot reaction time (except climbing cases).
   b. Normal aircraft pitch $\pm 15^\circ$ for conditions shown.
   c. Nominal parachute opening delay time and parachute deployment.
3. These curves are based on the best data available at time of publication, and are valid only for conditions indicated.

DATA AS OF: 1 January 1968

DATA BASIS: Test results

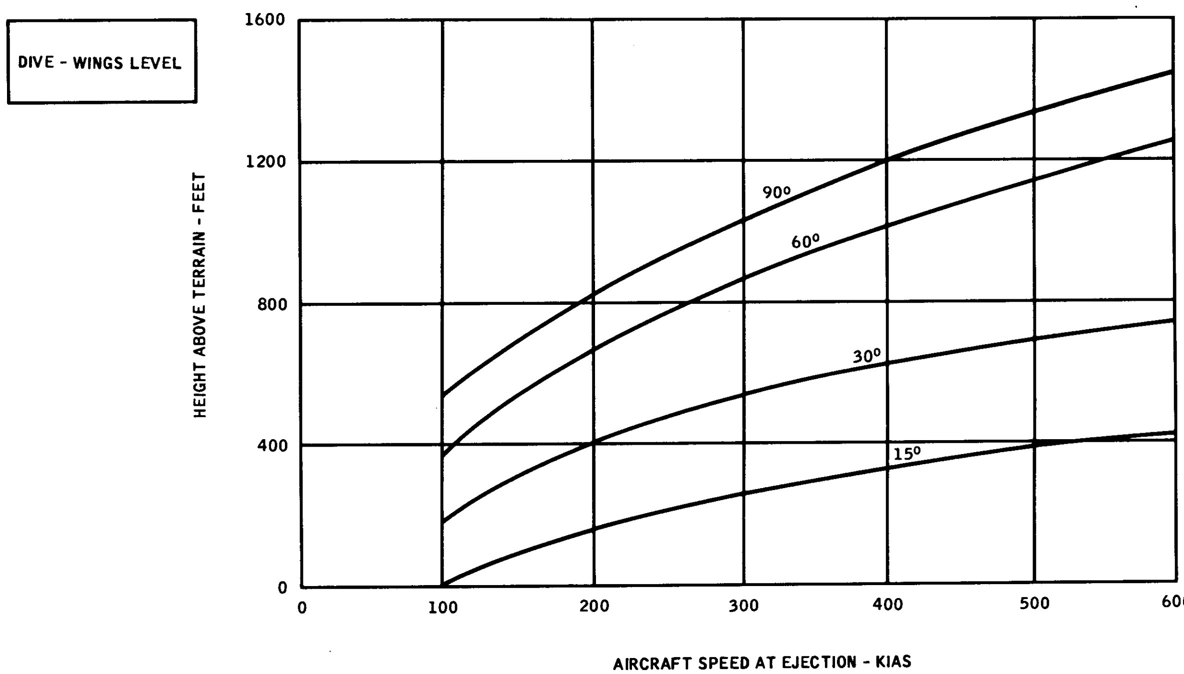
EXAMPLE:

To find minimum height above terrain for safe ejection at a rate of descent of 2500 ft/min.

1. Enter chart at 2500 ft/min rate of descent. A
2. Follow vertically upward to ejection capability curve. B
3. Read horizontally 340 feet minimum height above terrain. C

Figure 5-8. Terrain Clearance for Safe Ejection (Sheet 11)

TERRAIN CLEARANCE FOR SAFE EJECTION
ZERO - ZERO EJECTION SEAT



GG1-65

REMARKS: These curves do not include pilot's reaction time or safety factor.

DATA AS OF: 2 January 1968

DATA BASIS: Test results

Figure 5-8. Terrain Clearance for Safe Ejection (Sheet 12)

ejection occurs below the preset altitude and the automatic barometric ripcord actuator seems not to function (i.e., after the 2-second time delay), open the parachute with the manual ripcord (D-ring) when clear of the seat. The manual ripcord overrides the barometric release. If high-altitude ejection is made, free-fall to approximately 14,000 feet before opening the parachute. If the parachute must be opened manually after a high-speed ejection, wait at least 4 seconds after ejection for speed to reduce.

15. If the integrated harness is not automatically released following ejection, seat separation may be accomplished while falling by pulling the harness release handle, located on the right side of the pilot's seat. Lean forward to clear the chute from the back of seat and push clear of the seat. In the A-4E aircraft, actuation of the harness-release handle following ejection will disconnect the automatic parachute-actuator and will therefore require manual pulling of the ripcord (zero delay not installed). If zero delay is installed, actuator will fire 2 seconds after ejection.

16. The emergency oxygen bottle will be actuated automatically upon ejection. However, should the oxygen appear not to be flowing, pull the green ring on the left front inside corner of the seat pan.

17. At about 10,000 feet altitude, but before contact, the oxygen mask should be removed and the oxygen/radio hose should be disconnected.

18. Effectivity: All A-4E aircraft. Disconnect the left seat pack fastener. Pull the seat pack to the right and locate the life raft lanyard snap. Connect this snap to the right torso harness lap belt D-ring or the helicopter hoist ring, if worn. If descending into the water, inflate the MK-3C life preserver prior to entry.

19. Effectivity: All A-4F aircraft. During descent, the yellow release handle on the right side of the seat pack should be pulled to separate the lower part of the seat pack. This will cause the liferaft in the lower part to inflate and suspend from a 20-foot line.

20. In the event a parachute landing is made into the water or in a high wind which prevents normal spilling of the parachute canopy, disconnect both quick-disconnect fittings that attach risers to the torso-harness suit, thus jettisoning the parachute canopy. Do not disconnect the parachute-riser releases until after contact with the ground or water.

IMMEDIATE EJECTION

During any combined low altitude/low airspeed conditions, as in the landing pattern or immediately after launch, the alternate handle should be considered the primary means of ejection. Continue to fly the aircraft with the right hand keeping the wings level and maintaining altitude or the lowest possible sink rate while initiating ejection sequence with the left hand.

NOTE

During ejection, if either the harness release or automatic barometric parachute actuator cartridges fail to function properly, automatic seat separation and/or parachute deployment may not occur. Therefore, during any low altitude ejection, the pilot should attempt to "beat the seat" by manually pulling the harness release handle and then the parachute ripcord D-ring immediately after ejection.

Bailout

Bailout from high-performance aircraft is extremely hazardous, even under the most favorable conditions (level flight, slow airspeed), and is considered a last-resort method of escape. However, if the seat cannot be ejected, the following bailout procedures are suggested:

1. Pull green ring on seat pan for emergency oxygen.

2. Disconnect console oxygen and antiblackout hoses.

3. Select RAM air. NEW

4. Jettison canopy.

5. Pull harness release handle.

6. Lean forward to clear parachute past headrest.

7. Trim aircraft nosedown and roll inverted.

8. Position arms against body and let stick snap forward.

9. When clear of aircraft and below approximately 14,000 feet, pull ripcord D-ring.

Structural Failure or Damage

Loss of structural integrity may result from midair collision, exceeding structural limits, bird strikes, etc. The following procedure generally applies:

1. Reduce airspeed as much as practicable. If at low altitude, zoom to convert airspeed to altitude.

2. Determine whether adequate control of aircraft is available for continued flight. If not, eject.

3. If able to control aircraft, climb to minimum recommended ejection altitude, 10,000 feet or higher, at a reduced airspeed to prevent further damage.

4. Operate engine at minimum power to maintain level flight or slow climb if it is suspected that foreign objects may have entered the engine.

5. Whenever possible, request a visual inspection by another aircraft to assist in evaluating the damage.

6. Examine the slow-flight characteristics of the aircraft in the landing configuration at 10,000 feet, or above, prior to attempting a landing. Don't stall. Lower flaps in increments to determine if a split flap condition exists.

7. Land at the nearest suitable facility, using a precautionary approach, modified as necessary, unless the damage is determined to be negligible. If a bird has been ingested into the engine, even though there is no visible damage or indications of engine malfunctions, a prompt landing should be made, since a possibility exists that the engine may seize. Assume that the bird has been ingested if it strikes either side of the fuselage forward of the engine intake ducts.

Systems Failures

HYDRAULIC SYSTEMS FAILURE

Either the utility or the control hydraulic system warning light on indicates a loss of pressure to one or the other of the tandem hydraulic systems. Both UTIL HYD and CONT HYD warning lights on and a stiffening of the controls indicate a complete hydraulic failure.

NOTE

The manual flight control handle should not be pulled unless both the flight control and utility systems have failed.

No means are available to the pilot to restore hydraulic system pressure.

When operating on utility system only, actuation of various units normally operated by utility system pressure will cause a temporary decrease in the effectiveness of the flight controls.

CAUTION

- If a hydraulic system is lost in flight, be alert for evidence of fire, as the possibility of an engine-section fire exists.
- Do not attempt maneuvers requiring high control forces (such as high-speed pullouts) when it is known that one or both systems are inoperative.

COMPLETE HYDRAULIC FAILURE. In the event of a complete hydraulic system failure, as previously defined, the following procedure should be followed for flight control disconnect.

1. Terminate any accelerated maneuver.

2. Reduce airspeed to 200 KIAS, if possible. Lateral-control forces are high on manual control except at low speeds.

3. Trim aircraft laterally.

NOTE

As long as (normal) electrical power is available, the aircraft can be trimmed.

4. Manual flight-control handle . . . . PULL

NOTE

To ensure complete hydraulic power disconnect, relax stick pressure while pulling the manual flight control (MAN FLT CONT) handle.

5. Trim if necessary.

6. Terminate flight as soon as practicable.

7. An arrested landing is recommended whenever possible, to minimize fire hazard from possible hydraulic leak.

NOTE

Emergency extension of landing gear and a no-flaps approach and landing will be required. Spoilers and nosewheel steering will be inoperative. Landing gear safety pins should be installed as soon as possible after landing.

When a hydraulic power disconnect is made with asymmetrical wing or store loadings, the following recommendations are made:

1. Speed less than 200 KIAS prior to disconnect, if possible.

2. After disconnect, avoid excess longitudinal stick motion.

3. Plan approach to ensure that crosswind component is under heavier wing, if possible.

4. Recommended approach airspeed is 140 KIAS, with minimum final approach and touchdown airspeed of 125 KIAS. Minimum recommended lateral control

speed is 115 KIAS with hydraulic power failure and up to 1200-pound asymmetrical load.

5. When crosswind component exceeds 8 knots, an arrested landing is recommended to minimize ground handling problems during landing rollout.

NOTE

In case of excessive nose pitchdown, the use of speedbrakes may cause increased nose-down tendency due to the design of the speed-brake system.

The manual flight control handle should be pulled all the way out (approximately 1 foot) with a rapid and positive motion. This action will ensure a clean disconnect and will aid in preventing a tendency for the aircraft to roll as the switch to manual control is made. The manual flight control mechanism cannot be reset in flight once it has been disengaged.

If, for any reason, the manual flight control handle is pulled while hydraulic pressure is still available, a metallic thud will be heard when the stick is moved. This sound, caused when hydraulic pressure slams the piston against the end of the cylinder, is normal for the system under the above conditions and should not be a cause for alarm.

When a disconnect has been made and utility system pressure is available, it is possible to engage and utilize the AFCS to reduce stick forces.

NOTE

The tandem rudder actuator is not disconnected by the flight control disconnect handle, and high rudder forces can be expected.

ELECTRICAL SYSTEM FAILURE

MAIN GENERATOR FAILURE. Partial or complete failure of the main generator to provide the aircraft with the required output may be caused by generator constant-speed drive failure, blown fuses(s), and other mechanical or electrical discrepancies. Partial failures may result in a loss of one or more phases of ac, or reduced or fluctuating frequency or voltage, and may be impossible to detect from cockpit indications. The most likely signs of a partial failure will be TACAN unlocking and spinning, loss of air conditioning, erroneous attitude presentation of the all-attitude indicator with or without an OFF warning flag indication, or abnormally slow trim motor speed.

TACAN breaking lock-on, variation of instrument light intensity, sluggish or unstable gyro action, and variations in UHF background noise when associated with throttle reductions are an indication of impending generator drive transmission failure. Under this condition, continued throttle manipulation can induce various fuse failures including dc converter fuse failure. It is recommended that throttle manipulation be reduced to the minimum. If symptoms persist, deploying the emergency generator will prevent loss of power as long as airspeed is kept at or above 120 KIAS.

If the main generator should fail completely, all electrical equipment will be rendered inoperative immediately. The most easily recognizable indications of complete main generator failure occur simultaneously, as follows:

1. Landing gear indicators . . . . . UNSAFE
2. Flap position indicator . . . . . . OFF
3. All attitude gyro-indicator . . . . OFF FLAG visible
4. Trim position indicators . . . . . OFF SCALE
5. UHF/TACAN . . . . INOPERATIVE
6. Exterior/interior lights . . . . . INOPERATIVE

When a main generator failure is known or suspected, pull the emergency generator release handle. At altitudes above 25,000 feet, first reduce throttle to 90 percent or less, as fuel-boost pump will be lost and engine may flame out. When operating on the emergency generator, the emergency generator bypass switch must be set at NORMAL. If electrical power is not partially restored when the emergency generator is extended, ensure that the bypass switch is in NORMAL.

To prevent damage to the emergency generator, do not release the emergency generator at airspeeds above 500 KIAS or 0.91 IMN. At low indicated airspeeds, the emergency generator may not be capable of supplying adequate electrical power to support the equipment powered from the primary bus. For this reason, during operation with the emergency generator extended, the following precautions should be observed:

1. During flight at night or in adverse weather conditions, an indicated airspeed in excess of 120 KIAS should be maintained until the flight can be maintained by visual reference.

NOTE

External approach lights are operated through a dc approach light relay. With a dc electrical failure, the primary dc bus that operated the approach light relay will be inoperative and external approach lights will not be available. If a dc fuse is the problem, dc power may be regained by dropping the emergency generator on A-4E aircraft reworked per AFC 411 and all A-4F aircraft.

2. During landing approaches, an indicated airspeed of 120 KIAS should be maintained as long as power for the operation of the horizontal stabilizer-actuator is desired.

3. Advise tower that radio communciation will be lost during landing rollout.

NOTE

Emergency generator power to operate the TACAN, the angle-of-attack vane heater and the nesa glass heater will not be available when the landing gear is down. Power may be restored by first retracting the wheels and then cycling the emergency generator BYPASS switch.

DC CONVERTER FAILURE. Failure of the dc converter is indicated when dc-powered equipment malfunctions while ac-powered equipment is operating normally. The same indications will be present with an open dc power fuse. If the malfunction is an open fuse, deploying the emergency generator will restore dc power. If deploying the emergency generator does not restore dc power, a converter failure is confirmed and full ac power can be regained by selecting emergency generator BYPASS position.

EXTERIOR LIGHTS FAILURE. If exterior lighting is lost:

1. Maintain a sharp lookout to prevent collision with other aircraft.

2. Join up on another aircraft, if possible.

3. Request radar control for assistance if unable to join another aircraft.

INTERIOR LIGHTS FAILURE. If interior lighting is lost, use the cockpit emergency-floodlights or a flashlight to illuminate the instruments or the console.

CONSTANT-SPEED DRIVE (CSD) FAILURE. Any combination of the following should be considered as an indication of an impending failure:

1. TACAN unlocking.

2. AJB-3 malfunction (with or without an OFF flag).

3. Gear and flaps indicator failure.

4. Intensity of cockpit lights with throttle movement.

Failure of the CSD can cause the ac-dc converter ac primary (monitored) fuses to open. Dc power can be restored by extending the emergency generator with the emergency ac generator BYPASS switch in the NORMAL position.

TACAN FAILURE

LOSS OF BEARING. When bearing information is lost, any of the following may be used (listed in order of preference):

1. Select alternate antenna position.

2. Homing feature.

a. AN/ARA-25 homing feature (all A-4E).

b. AN/ARA-50 or ARR-69 homing feature (all A-4F).

3. UHF-DF steer.

4. Mileage indication may be used to find the station as follows:

a. Identify station.

b. Turn as necessary to stop mileage and establish an arc from station.

c. Note RMI heading at wingtip which is thought to be in direction of station.

d. Turn left or right toward noted heading.

e. If mileage increases, turn to reciprocal heading. Otherwise, continue inbound to half the initial distance and repeat preceding steps 4a. through 4d. until DME reading is 20 miles or less. Continue inbound on predetermined heading. Observe station passage and range when distance begins to increase.

LOSS OF DME

1. Select alternate antenna position.

2. To determine the range, turn 30 degrees off the inbound heading to the station until a bearing change of 10 degrees from the original bearing is accomplished. Note the time required. Turn to place the station on the nose again. Time to the station is approximately three times that required to change the bearing 10 degrees.

GROUND STATION INTERFERENCE. Ground station interference is recognized by an erroneous lock-on by the No. 2 needle, by erroneous mileage, and by usually garbled identification. Use dead reckoning until free of interference from the undesired station or select other means of navigating.

OTHER TACAN MALFUNCTIONS. Tube failure or improper adjustment may cause a 40-degree error in lock-on in either direction from the correct bearing. ID 307 malfunctioning may cause errors in lock-on in multiples of 40 degrees in either direction from the correct bearing. Detection of these discrepancies may be accomplished by observing the rapid drift of the No. 2 needle 40 degrees from its previously stabilized position or by observing that the rate of closure on the DME is less than normal with the No. 2 needle on the nose of the aircraft.

1. Change channels so as to unlock the No. 2 needle, and then return to the proper channel in an attempt to get a proper lock-on.

2. Take a heading 40 degrees more or less than indicated by the No. 2 needle and fly to the station, observing DME closure rate.

3. Use AN/ARA-25 (A-4E), AN/ARA-50, ARR-69 (A-4F), or UHF-DF facilities, if available.

COMPASS SYSTEM FAILURE

If the compass system will not remain in SYNC during the slaved operation, switch to FREE DG and set correct north or south latitude in on the compass controller. Set heading to match the standby magnetic compass. If the compass card fails or is unreadable due to spinning, use the standby compass. Note the magnetic deviation on the deviation card when using the standby compass as deviation errors of up to 10 degrees are possible.

FLIGHT CONTROLS SYSTEMS FAILURE

RESTRICTED FORWARD STICK TRAVEL. An aircraft nose-up out-of-trim condition resulting from up elevator and restricted forward stick travel may be caused by an uninitiated disconnect of elevator

hydraulic power. The attitude problem may be alleviated by low airspeed, nose-down trim, extended flaps and landing gear, and all available forward stick. To restore full stick travel, follow the procedure for complete hydraulic failure. If the condition persists, relax pressure on the stick while pulling the manual flight control handle again.

HORIZONTAL STABILIZER ACTUATOR FAILURE. If the stabilizer actuator should fail while the aircraft is trimmed for high speed flight, a landing can be accomplished by flying the aircraft onto the runway with the flaps retracted, at an airspeed which ensures adequate control. Landing with the flaps retracted is recommended due to the nosedown trim change which occurs when the flaps are extended. Since the inoperative stabilizer cannot be moved to correct for the trim change, the elevator would have to be employed, in effect reducing the amount of elevator travel remaining to accomplish the landing. Maximum elevator effectiveness is achieved by burning down to 600 pounds of fuel remaining to provide an aft CG condition.

HORIZONTAL STABILIZER RUNAWAY TRIM

1. In the event of runaway longitudinal trim, first use MANUAL OVERRIDE control in the opposite direction to stop the runaway condition and to obtain the correct trim. When the acceptable trim has been regained and it is necessary to continually use the MANUAL OVERRIDE to prevent a recurrence of the runaway trim, proceed as follows:

   a. Deploy emergency generator. This action provides the only means of deenergizing the stick switch/relay control circuit, the logical cause of the runaway trim.

   b. If the horizontal trim disconnect switch is incorporated on the aircraft, the main generator may be regained by first activating the trim disconnect switch then selecting the emergency generator BYPASS position.

2. Remain on hydraulic power control system.

3. If unable to retrim, adjust airspeed as required to minimize stick forces.

NOTE

The horizontal trim disconnect may be used during critical phases of flight such as field takeoffs and catapult launches, to avoid horizontal stabilizer runaway trim conditions.

NORMAL AILERON TRIM FAILURE. If aileron trim fails to respond while attempting normal corrective trim, do not attempt to check the trim circuit by operating the trim switch in the opposite direction. This will make the out-of-trim condition worse.

AILERON TRIM RUNAWAY

1. Stop runaway aileron trim by extending emergency generator.

2. Remain on hydraulic power control system.

3. Burn down excess fuel, and land.

With the trim jammed at maximum deflection in either direction, the forces required to return the stick to neutral will be moderate.

WARNING

- Do NOT disconnect flight control system.
- At high speeds on manual control, lateral forces will be uncontrollable if aileron trim has runaway.

RUDDER TRIM RUNAWAY

1. Stop runaway rudder trim by extending emergency generator.

2. Remain on hydraulic power control system.

3. Burn down excess fuel, and land.

The force required to return the rudder to neutral will be moderate.

AFCS MALFUNCTION. If the flight controls operate in an erratic manner, such as uncontrolled lateral or pitch oscillations, or if a "hardover" condition occurs, whether operating with AFCS in STANDBY or OFF, proceed as follows:

1. Depress autopilot override button on control stick.

2. If normal control is not restored and AFCS standby switch is in STANDBY, turn switch OFF.

3. If this does not restore normal conditions, deploy emergency generator.

ROYAL AUSTRALIAN NAVY

SUPPLEMENT 1
to
AP(RAN)NA-01-40AVC-1 SEC V Page 5-36

INTRODUCTION

1. This supplement is promulgated to detail the procedures to be followed in the event of a horizontal stabilizer trim malfunction post mod Skyhawk RAN 3

HORIZONTAL STABILIZER TRIM DISCONNECT SWITCH

2. Modification /Skyhawk/RAN 3 has been adopted to fit a trim disconnect switch into the port console. This switch, when selected to DISCONNECT will isolate all AC power to the horizontal stabilizer trim system, thus preventing or arresting a runaway trim.

It is intended that the switch be left in the Connect position at all time except during the take-off phase. For this it is to be selected to DISCONNECT so as to preclude a runaway trim during this critical stage.

3. In the event of a runaway trim developing when at height proceed as follows:

(1) Select the trim disconnect switch to the DISCONNECT position. This will remove all power from the system, and arrest the runaway trim condition.

(2) Under some circumstances it may still be possible to re-trim by means of the MANUAL-OVERRIDE by following this sequence:

(i) Select MANUAL OVERRIDE in the direction of trimdesired. This will mechanically close the correct relay in the trim control relay, then:

(ii) Select the trim disconnect switch to CONNECT until the desired trim has been obtained, the re-select DISCONNECT, and release the MANUAL OVERRIDE.

4. Should the steps described in para 2 produce no reaction, it can be assumed that the trim control relay is stuck, and no re-trim facility will be possible either through the normal or emergency power system.

5. The introduction of this modification now makes it unnecessary to stream the emergency generator, upon the occurance of a runaway trim, except as a last resort if all else fails.

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4. If normal aileron trim is not restored upon disengagement of AFCS, move AFCS aileron trim NORM/EMER switch to EMER position. This should restore normal operation.

NOTE

Do not actuate flight control power disconnect to rectify an AFCS malfunction.

FROZEN CONTROLS (ICING). Icing may cause freezing of the lateral or longitudinal flight controls. If this occurs, DO NOT pull the disconnect and attempt to fly using manual control, but proceed as follows:

1. Strike stick smartly. It may require as much as 50 pounds or more of force to free controls.

2. If unable to free controls, fly with trim tabs and rudder to an altitude below freezing level and repeat step 1.

The possibility of experiencing this condition can be minimized by setting the horizontal-stabilizer trim to 0 degrees prior to engine shutdown to prevent rain and spray entering the elevator, and by moving the controls through full-travel immediately prior to takeoff.

SPOILER MALFUNCTION

If spoilers deploy in flight, proceed as follows:

1. Ensure that power is above 70 percent.

2. Spoiler switch in OFF.

3. Deploy emergency generator.

4. If none of the above steps succeeds in closing the spoilers, slow flight aircraft to 5000 feet AGL or above to check landing characteristics.

If one spoiler fails to open during landing roll, proceed as follows:

1. Control swerving with corrective rudder, brakes, nosewheel steering, and aileron, as required.

2. Raise flaps as soon as possible.

3. When control is regained, place spoiler switch in OFF.

SPEEDBRAKE FAILURE

In the event of a speedbrake control valve solenoid or dc electrical failure, operate the speedbrakes as follows:

1. Speedbrake switch . . . . . OPEN OR CLOSE, AS REQUIRED

2. Emergency speedbrake knob . . . . PULL TO OPEN OR PUSH TO CLOSE, AS REQUIRED

The emergency speedbrake control may be used to override the electrical signal, but the handle must be held in the desired position. In case of hydraulic and electrical failures when the speedbrakes are open, the speedbrakes may be closed to the trail position by momentary actuation of the manual control.

FUEL SYSTEM FAILURE

FUEL QUANTITY INDICATOR FAILURE. If the indicator needle will not move or if it continuously rotates, manage the fuel using the flowmeter and the best estimate of fuel remaining. If in company with other aircraft and the initial fuel load and mission performed have been identical, the fuel remaining will usually be within a few hundred pounds of that of the accompanying aircraft. Land as soon as practicable, in either case.

FUEL TRANSFER FAILURE. The fuel transfer caution light will come on to indicate fuel transfer pump failure.

When the fuel transfer caution light remains on, assume that the usable fuel remaining is either 1600 pounds or the indicated fuel quantity (whichever is less) and land as soon as possible.

NOTE

- The fuel transfer caution light will come on in flight or on the ground when engine rpm is approximately 70 percent or below, or when wing fuel is actually depleted.
- Maneuvering flight may cause the light to come on intermittently.

When the fuel remaining in the fuselage tank falls below approximately 1100 pounds (the level at which the wing tank capacitance units are moved from the indicating circuit), there will be an abrupt drop in fuel quantity indication to a reading corresponding to the fuel remaining in the fuselage tank. When the wing tank transfer pump fails, only the fuel remaining

in the fuselage fuel tank will be available. However, if the external fuel tanks contain fuel and are pressurized, fuel will flow to the wing tank until it is full and then will flow directly to the fuselage cell until drop tank fuel is exhausted. In aircraft reworked per A-4 ASC 317, the drop tank fuel may be transferred directly to the fuselage cell without first filling the wing tank by placing the FUEL TRANSFER BYPASS (A-4E) switch in FUS ONLY. In A-4F aircraft, the switch is incorporated on the engine control panel and is labeled AIR REFUELING FUSELAGE ONLY.

When drop tank fuel has been exhausted in A-4E reworked per A-4 ASC 209, place the emergency transfer switch in EMER TRANS. This will pressurize the wing tank, forcing fuel to the fuselage cell through the path of least resistance (air refueling plumbing and/or normal fuel lines between the transfer pump and fuselage cell).

With a centerline drop tank installed, place the drop tank transfer switch in the PRESS position to prevent wing fuel from flowing into the centerline tank when the emergency transfer system is activated.

With an air-refueling store installed, place the ship-tank switch on refueling control panel in the FROM STORE position to prevent wing fuel from flowing into the store when the emergency transfer system is activated.

With the emergency transfer switch in EMER TRANS position, a static pressure of 6 psi is imposed in the wing tank. Inadvertent dumping of wing tank fuel may occur through a pressure relief and dump valve if the wing tank is overfilled or if the wing tank vent becomes blocked with fuel. Inadvertent dumping of fuel will be apparent from a rapid drop in fuel quantity indication (about 700 pounds per minute). It may be necessary to turn off the emergency fuel transfer switch temporarily to permit a decay of wing pressurization and the dump valve to reseat.

FUSELAGE TANK FLOAT VALVE FAILURE. If the fuselage tank float valve sticks in the closed position, the fuel transfer caution light will not come on, and the only indication of a failure will be the abrupt drop in fuel quantity to approximately 1100 pounds (the reading corresponding to the fuel remaining in the fuselage tank). If there is fuel in the external tanks and they are pressurized, this will not normally occur until external fuel is depleted as it will continue to transfer to the fuselage tank through the air refueling plumbing. When the fuel quantity drops unexpectedly to 1100 pounds, whether or not the fuel transfer caution light is on, proceed as follows:

1. Ensure that drop tank transfer switch is in PRESS.

2. The float valve may be unseated by rapid oscillation of the control stick, within the structural limits of the aircraft. If this action unseats the valve, landing at the nearest suitable facility is recommended as there is a possibility that the valve will stick again.

3. If preceding steps 1 and 2 are not practicable or are unsuccessful, and aircraft has been reworked per A-4 ASC 209 (A-4E), place the emergency transfer switch in EMER TRANS and proceed as described for Fuel Transfer Pump Failure. If there is still fuel in the external tanks and drop tanks transfer is normal, do not select EMER TRANS until it is depleted.

4. Land as soon as possible.

DROP TANK TRANSFER FAILURE. Unless the drop tank fueling switch in the aft engine compartment is placed in the OFF position after fueling the drop tanks and before takeoff, normal fuel transfer from the drop tanks will not be possible in the air. However, drop tank transfer may be accomplished by extending the emergency generator.

OXYGEN SYSTEM/MASK FAILURE

If no oxygen is available because of system depletion or failure, or if mask malfunctioning or contaminated oxygen is suspected, proceed as follows:

1. Place the oxygen switch in OFF and pull green ring. Descend rapidly to cabin altitude of 10,000 feet or below.

2. Remove mask if unable to breathe or when bailout oxygen is depleted.

3. If fuel remaining permits, descend to 10,000 feet pressure altitude or lower and select RAM air.

4. Land as soon as practicable.

AJB-3/AJB-3A FAILURES

Failures may occur where roll, pitch, or heading indications are lost singly or in combination. The OFF warning flag will always promptly indicate the loss of 28 vdc. One or two phases of ac may be lost, yet the indicator will continue to function for an indefinite period without an OFF flag indication, even though the information presented may be erroneous. Many other failures can occur that will not be indicated by the OFF flag. Backup instrumentation is provided by a standby gyro, turn and bank, magnetic compass, etc, to permit continued flight. Intentional

flight in instrument conditions with any type of AJB-3 failure should be avoided whenever possible.

NOTE

In aircraft which incorporate the AJB-3A, failures are identical to the AJB-3 except that with loss of any phase of ac power the OFF warning flag will be visible.

PITOT-STATIC SYSTEM FAILURE

When airspeed indications are lost or suspected to be erroneous, the altimeter and vertical speed indications will probably be similarly affected. Turning the pitot heat ON should promptly restore normal operation, if the malfunction was due to pitot-tube icing. If it is apparent that icing is not the cause, place the cockpit pressurization switch in RAM and break the glass from the vertical speed indicator. This may restore operation by providing a source of static pressure, but instrument readings will not be accurate. There will be a pronounced lag, and the vertical speed indications will be reversed. Use the cabin altimeter as a rough cross-check on altitude.

AIR-CONDITIONING TEMPERATURE CONTROL FAILURE

Occasionally, malfunctions will occur which cause the air conditioning system to provide either full-hot or full-cold air to the cockpit. Manual positions are provided for the temperature control knob with which the pilot can select a desired temperature level. If the manual temperature is inoperative and the pilot becomes uncomfortably hot or cold, the NORMAL/RAM switch should be placed in RAM. If it is not practical to operate in RAM, adjust the eyeball diffusers and defrost control to minimize airflow. Use minimum rpm required for flight. Changing altitude should extend the period the adverse temperature can be endured. Land before debilitating effects reduce the pilot's capability to do so safely. As a last resort, if the cockpit temperature is unbearable and the pilot is unable to switch to RAM operation, the canopy should be jettisoned, if doing so would improve the situation.

LOSS OF CANOPY

When the canopy is lost/jettisoned after takeoff or in flight, slow aircraft to 200 KIAS or below. Since surface control damage may result from canopy loss, slow-flight of the aircraft should be accomplished prior to landing. If loss occurs immediately after takeoff, the pilot should maintain speed commensurate for aircraft weight and enter downwind for landing. If loss occurs at high altitudes, an immediate descent to warmer temperatures should be made before the pilot is incapacitated. If able to descend to an altitude where a comfortable temperature exists, the pilot should decide whether to return to home base or land at the nearest facility. Should existing conditions preclude descent to acceptable temperatures, the pilot should eject prior to becoming incapacitated.

NOTE

After canopy loss/jettison, the pilot should be alert for excessive flapping of the face curtain. If such condition develops, lower the ejection seat safety handle until transition to final landing.

AIR REFUELING STORE FAILURE

HOSE JETTISON. Hose jettison may be desirable when store hydraulic pressure is lost or when an electrical malfunction occurs which prevents retraction of the drogue. When hose jettison is elected, proceed as follows:

1. Reduce airspeed to 250 KIAS or less.

2. Hold back the spring-loaded channel guard and lift the hose jettison switch and move to the JETTISON (aft) position.

NOTE

A 5- to 20-second time delay will occur prior to the hose jettisoning.

3. Do not change the position of the hose jettison switch after jettisoning the hose and drogue.

If hose jettison is accomplished at a speed greater than 250 KIAS, excessive tension on the hose due to hose stretching may pull the hose from the crimper after the guillotine is fired. Hose jettison is available on emergency generator. Fuel dumping from the store is not possible on emergency generator. Fuel transfers automatically to the wing fuel tank when normal electrical power is lost or when operating on emergency generator.

ELECTRICAL FAILURE. Should the main generator or store electrical system fail with the drogue extended, the ram air turbine will automatically feather, transfer of fuel to the receiver aircraft will terminate, and automatic transfer of all external fuel will commence. Store hydraulic power will terminate as the ram air turbine feathers. On emergency

generator, the drogue cannot be retracted and any remaining fuel in the store cannot be dumped. Hose jettison is the only store system available on emergency generator.

If failure occurs which prevents retraction of the drogue, proceed as follows:

1. Ashore: Jettison the hose and drogue as necessary, only if indicated by other considerations, such as field arrestment required, decreased drag necessary for safe return, etc.

2. Carrier-based: Jettison hose and drogue, if possible, before landing. Make a normal approach. Advise ship of condition so that flight deck personnel can be warned.

CAUTION

Any evidence of a hydraulic leak observed during refueling operation should immediately be reported to the tanker pilot and the store should be secured.

DROGUE AND COUPLING LOST AND/OR HOSE SEVERED (OTHER THAN HOSECUTTER SEVERANCE). Should the basket or hose be lost, the remaining hose will automatically retract due to the loss of the drag created by the basket. This is accomplished by the 200-pound force continually applied by the hose reel assembly. The following procedure is recommended:

1. Place drogue position switch in RET.

2. Deploy emergency generator.

3. Place refueling master switch in OFF.

4. Select emergency generator bypass to remain on main generator.

NOTE

The store may be dumped, but the refueling master switch shall not be placed in ON.

The preceding procedure is recommended to reduce the fire hazard created by actuation of the hose jettison. A secondary procedure is as follows:

1. Place drogue position switch in RET.

2. Place hose jettison switch in JETTISON and leave in this position until after engine shutdown.

LOSS OF STORE FEATHERING CONTROL. If unable to feather the store air turbine after drogue retraction, check drogue position indicator. If drogue indicates RET, observe limiting airspeed of 300 KIAS or 0.80 IMN for remainder of flight. If the drogue position indicates TRA but drogue is reported to be retracted, slow to 230 KIAS and recycle drogue in an attempt to obtain a RET indication. If not successful, slow to 200 KIAS or 0.80 IMN for the remainder of the flight. After a shore-based landing, drogue will probably trail out and sustain damage. For shipboard, make a normal approach. Advise ship of possible necessity to tie up or carry drogue as aircraft is taxied from landing area.

BANNER TOW TARGET FAILURE

1. In the event of MK 51 bomb rack malfunction and/or inability to release a towline and banner, a landing with towline and banner attached can be made on runways of 10,000 feet or greater length. Make a steep diving approach to a landing approximately 5000 feet down the runway. The chase aircraft can verify banner terrain clearance during the landing approach. Drag caused by the banner and towline on the runway after landing will normally obviate the need for an arrested landing.

2. In an emergency situation requiring immediate release of the towline and banner, the MK 51 rack assembly can be electrically released from the AERO-7A-1 bomb rack by using the emergency bomb release circuit. This procedure can be employed if the normal release circuit malfunctions and landing with the towline and banner is not considered safe.

Lost/Downed Plane Procedures

LOST PLANE PROCEDURES

If unable to orient yourself, either using available NAVAIDS or visually, proceed as follows:

With Radio

1. Admit being lost.

2. If at low altitude, climb to increase endurance and communications/radar detection range.

3. Conserve fuel by flying at maximum endurance airspeed until oriented.

4. Squawk EMERGENCY IFF codes.

5. Switch to GUARD channel: 243.0 mc.

6. Broadcast the work "PAN" or "MAYDAY" three times, as appropriate.

7. Transmit type of aircraft, estimated position, course, speed, altitude, and fuel supply in minutes.

8. State difficulty.

9. State assistance desired or intentions.

10. Transmit for D/F steer as requested.

11. Once in contact with a radio facility, make a broadcast that you are in contact with ___________ and ask all others to remain SILENT unless called. Do not shift frequency or ground stations unless necessary.

12. Comply with instructions given.

13. When oriented and decision is made as to destination, use maximum range airspeed to get there.

With Receiver Only

1. Use with Radio steps, if applicable.

2. Fly two triangles to the right (1-minute legs). Repeat pattern every 10 minutes. Meanwhile, maintain estimated best course.

3. Monitor GUARD channel and comply with instructions given by responding station.

Without Radio

1. Use with Receiver Only steps, if applicable.

2. Fly two triangles to the left (1-minute legs). Repeat pattern every 10 minutes. Meanwhile, maintain estimated best course.

3. Maintain lookout for interceptor. Refer to FLIP planning document or en route supplement emergency procedures for current day-and-night interceptor procedures and signals.

Remember the Five "C"s

1. Confess
2. Communicate
3. Climb
4. Conserve
5. Comply with the instructions.

DOWNED PLANE PROCEDURES

SINGLE AIRCRAFT. If the situation permits, prior to ejection, crash landing, or ditching, make every effort to switch IFF code to EMERGENCY settings and send a MAYDAY message on the GUARD channel. Turn IFF OFF just prior to ejection. Conditions existing after abandoning the aircraft will dictate whether to remain near the scene of the crash or attempt to find assistance.

SECTION. If one member of a section goes down, the other member should:

1. Establish contact with ground station, preferably GCI site or radar control agency. Switch IFF to EMERGENCY and UHF to GUARD.

2. Make every effort to follow pilot during descent, keeping him in sight at all times. Note as accurately as possible his position on the ground or in the water, using bearings and distances from known prominent landmarks or navigational aids to direct rescue planes or boats to the scene.

3. Maintain sufficient altitude to ensure radio contact with rescue facility.

4. Request assistance of other aircraft if necessary to maintain communications with and continuous surveillance of survivor.

5. Leave area with sufficient fuel remaining to POSITIVELY ensure return to base or an alternate field.

DIVISION. Everything previously mentioned for downed plane procedures holds true if there are more than two members in the flight. Some additional procedures can be followed which generally will ensure a greater likelihood of a successful rescue.

1. The other member of the section in which the downed pilot was flying will follow pilot during his descent and circle survivor at low altitude and a maximum endurance airspeed, keeping him in sight at all times.

2. Other members of the flight will remain at altitude, alert the appropriate SAR facilities, relay communications, and conserve fuel.

OTHER CONSIDERATIONS

1. The flight leader will shift all communications to the local SAR frequency when directed by the SAR coordinator.

2. All aircraft not specifically requested to assist will remain clear of the area.

3. Arrange for a relief on station in a timely manner, fuel permitting.

4. The aircraft on low station must not become distracted from the primary requirement of flying his aircraft. Maintain flying speed. Don't fly into ground or water.

5. Turn off emergency IFF code when departing from scene.

LANDING EMERGENCIES

No-Radio Pattern Entry and Landing (VFR)

DAY

Determine the duty runway by observing traffic or the tetrahedron. Enter the break, maintaining a vigilant lookout for other aircraft. Rock the wings slowly (about 20-degree bank) until over midfield. Make a standard break to the downwind. Double-check gear down at the abeam position. During the approach, periodically check the tower for a light signal. If a red light or no light is received, wave off (fuel permitting) and enter downwind. Do not raise the landing gear unless departing the pattern. Be alert for aircraft breaking above. Airfields with dual runways should attempt to designate either the left or right side for no-radio landings.

SECTION OF AIRCRAFT

The no-radio approach may be straight-in or by entry into the break. Aircraft with radio failure will fly on the starboard wing (port wing if the field has a right-hand pattern). If entering the break, the no-radio aircraft will break with the leader. The standard signal for speedbrakes will be given by the leader to slow to 220 KIAS. When airspeed is below 220 KIAS, the standard signal for gear down will be passed and both aircraft will lower gear and flaps. Aircraft will continue into the groove in section. When the leader has the ship/runway in sight and the no-radio aircraft has been cleared to land, the leader will point to the ship/runway and detach wingman by blowing a kiss and pointing to wingman. The leader will then level-off, obtain lateral separation, and parallel the final bearing/runway heading until the wingman is safely on deck. In the event of a waveoff or bolter, the wingman will rejoin the leader, and the procedure will be repeated.

NIGHT

In the event of radio failure with the external lights operative, follow the day procedure, adding a series of rapid, manual flashes, with the external lights on BRT/STBY, to the wingrock.

When complete electrical power is lost at night, the only course of action open to the pilot, short of ejection, is to maintain an extremely vigilant lookout, and observe traffic or the tetrahedron to locate the duty runway. If landing traffic cannot be observed on the runway, to ascertain that the runway is clear, attempt to alert the tower, prior to landing, by making a low pass parallel to the lighted runway, close aboard the tower, jazzing the throttle. Land, if possible, when the pattern is clear of traffic.

Night (or IFR)

The leader (or aircraft with good radio) obtains marshal (shipboard) or approach clearance (shore-based) and leads the no-radio aircraft to meatball. See figure 7-10 for light signals. Aboard ship, hook will be lowered prior to departing marshal. Bolter and waveoff procedures are the same as for day.

LIGHT SIGNALS AT NIGHT

After the pushover from marshal (shipboard) or initial approach, fix the first blinking of leader's external lights means speedbrakes out, second blinking means gear and flaps down, third blinking means wingman take over visually and land the aircraft.

Precautionary Approches

A precautionary/flameout approach should be made when engine failure is considered imminent. In this situation, the most important factor is to land the aircraft safely as soon as possible at the nearest suitable field. The precautionary/flameout approach is designed to afford the pilot a means of landing safely and expeditiously while providing him a safe ejection altitude should he elect to discontinue the approach.

HIGH PRECAUTIONARY/FLAMEOUT APPROACH

The high precautionary/flameout approach is shown in figure 5-9. The pattern consists of a 270-degree approach, with checkpoints at the initial, 180-degree, and 90-degree positions. The optimum airspeed of 180 KIAS is suitable for gross weights up to 14,000 pounds with or without empty external drop tanks and/or empty multiple bomb racks (MBR's). An additional 5 knots is required for each 1000-pound weight increase above 14,000 pounds. The minimum acceptable airspeed during the approach until flare is 170 KIAS. The high precautionary/flameout approach should be used only when the following criteria are met.

1. Suitable field available (at least 8000 feet of runway with arresting gear and crash equipment).

AIRSPEED AND ALTITUDE	OPTIMUM	USABLE BAND
APPROACH SPEED-KNOTS	180	170 TO 200
INITIAL POINT ALTITUDE	7000'	6000' (GEAR UP)
180° POINT ALTITUDE	4500'	4000' TO 5000' (GEAR DOWN)
90° POINT ALTITUDE	3000'	2800' TO 3200' (GEAR DOWN)
FINAL APPROACH ALTITUDE	1000'	500' MINIMUM
FLARE	200'	200' TO 300'

OPTIMUM CONFIGURATION: GEAR DOWN–FLAPS UP.
ALL ALTITUDES SHOWN ARE TERRAIN CLEARANCE.

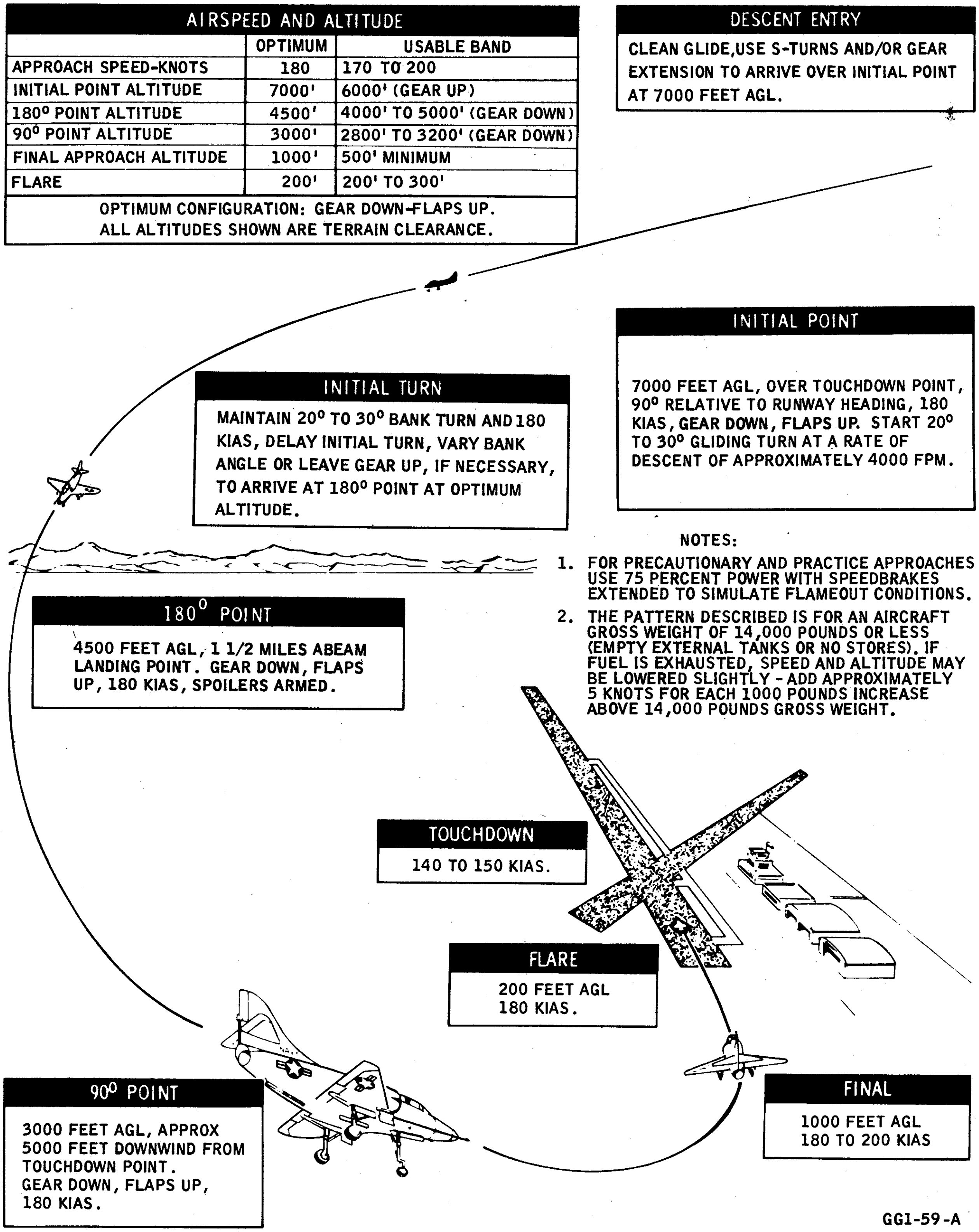


Figure 5-9. High Precautionary/Flameout Approach

2. High level of pilot proficiency.

3. Daylight weather conditions where visual contact with the runway can be maintained throughout the approach.

4. Crosswind component less than 15 KNOTS.

THE PATTERN

ENTRY. Entry into the high precautionary/flameout approach pattern should be executed to arrive at the initial point with the emergency generator and landing gear extended and the aircraft trimmed for 180 KIAS. The aircraft gross weight should be reduced to a minimum by jettisoning external stores and/or dumping fuel as necessary. The manual flight control disconnect handle should not be pulled unless engine seizure is imminent or normal flight control is lost. Excessive altitude can be effectively dissipated by a figure-8 pattern making all turns toward the initial point. Early landing gear extension and/or gentle S-turns can be effective in dissipating three to four thousand feet of altitude. If insufficient altitude necessitates interception of the pattern at a position other than the initial point, landing gear extension may be delayed as necessary.

INITIAL POINT. The initial point is a point directly above the runway, heading 90 degrees relative to the intended landing heading. Optimum altitude is 7000 feet AGL with emergency generator and landing gear extended, flaps up, and shoulder harness locked. A 20- to 30-degree bank angle should be used to turn to the proper 180-degree position. The 180-degree position closely approximates the normal no-flap 180-degree position over the ground. From this position, the bank angle may be varied as necessary to arrive at the optimum 90-degree position.

180-DEGREE POSITION. The 180-degree position is directly abeam the intended landing point with the aircraft headed in the opposite direction to the landing runway. The optimum position is approximately 1 1/2 miles from the landing point, 4500 feet a 180 KIAS. Compass heading is a good reference to determine the 180-degree position when checking altitude. The turn should never be stopped to dissipate excess altitude nor the airspeed reduced below 170 KIAS in an attempt to regain lost altitude. Gear handle down. Arm spoilers when making high precautionary approach.

90-DEGREE POSITION. The 90-degree position is approximately 1 mile downwind from the intended landing point, 3000 feet AGL, 180 KIAS, landing gear locked down. From this position, bank angle can be varied to effect satisfactory lineup. Excessive altitude can be dissipated by lowering the nose, permitting airspeed to increase. Prescribed airspeed is sufficient to arrest rate of descent at any point in pattern prior to commencing flare.

FINAL. The aircraft is on final approach when lined up with the landing runway. Optimum conditions are 1000 feet AGL, 2000 to 3000 feet of straight-way, and 180 KIAS. If high, altitude should be lost by nosing over slightly permitting airspeed to increase. Minimum airspeed on final is 170 KIAS. If excessive airspeed exists on final (over 200 KIAS), manual speedbrake extension is effective in reducing airspeed. Speedbrakes should be used only if excessive airspeed exists and landing on the runway is ensured.

FLARE. The flare should be commenced 200 to 300 feet above the runway at 180 KIAS. THIS IS A CRITICAL PHASE OF THE APPROACH AND REQUIRES OPTIMUM PILOT TECHNIQUE. A sequence of minor nose rotations to produce a series of slight reductions in rate of descent (step effect) allows time for constant appraisal of the flare at each incremental position and provides a satisfactory means for effecting a smooth landing. Airspeed dissipates very rapidly (power off) during the flare.

LANDING. Optimum touchdown speed is 140 to 150 KIAS. Approximately 5000 feet of runway will be required for stopping at these airspeeds. Airspeeds below 140 KIAS should be avoided to prevent a hard landing. A safe landing can be accomplished at touchdown airspeeds as high as 180 KIAS if sufficient runway remains. For most effective braking, moderate brake pedal forces should be applied as rapidly as possible after touchdown. Pedal forces should be decreased gradually as the aircraft decelerates to a taxi speed. If insufficient runway remains, the arresting hook should be extended for emergency arresting gear engagement.

ADDITIONAL CONSIDERATIONS. Effort must be made to fly the optimum patterns, and many variables must be considered. Only through repeated practice can the individual pilot acquire the proficiency to properly assess his approach. Some considerations which should be taken into account are:

Determination of Landing Point. The selected landing point should be 2000 feet down the runway. Once the landing point has been selected, all checkpoints in the pattern are referred to it. Touchdown shouid be effected as soon as possible once a safe landing on the runway is ensured.

Altitude Adjustment Considerations. Altitudes as low as 500 feet below optimum can easily be compensated for by varying bank angle slightly during the approach. Altitudes 500 feet or more below optimum require changes in the basic pattern; i.e., closer 180-degree position, 90-degree position, delay lowering landing gear. However, gear handle must be placed in DOWN position by the 180-degree position to ensure the gear down on final. The required changes can only be determined by continuous analysis of ground track position, airspeed, and altitude.

Airspeed should never be decreased below 170 KIAS in an effort to decrease the rate of descent. Lack of sufficient airspeed to stop the steep rate of descent may not only result in an unsafe landing but may also preclude safe ejection. Excess altitude should be dissipated by lowering the nose, allowing airspeed to increase, rather than by adjusting pattern.

Effects of Aircraft Configuration Changes. The increased drag of three empty MBR's causes less than a 500-fpm increase in the rate of descent. The optimum flameout pattern provides sufficient altitude to compensate for this slight increase. The flare characteristics with MBR's are more critical due to the increased drag and require exacting pilot technique.

Effects of Wind. Wind velocity and direction is of vital importance during the flameout approach. A 15-knot wind will displace the touchdown point approximately 3000 feet downwind if corrections are not made. Correction for wind should be effected by varying bank angle to maintain optimum position if required in the approach. Actual flameout landings should not be attempted when the crosswind component exceeds the specified NATOPS limitations for landings with normal or manual flight controls.

Figure 5-10 deleted.

FLIGHT CHARACTERISTICS WITH ENGINE FAILURE

NOTE

If, during the high precautionary approach, the engine should fail (flameout, seizure, etc.) and the pilot elects to continue the approach to touchdown, it should be understood that the pilot must be well qualified in the A-4E/F and have assessed the situation to the fullest extent.

ADEQUACY OF FLIGHT CONTROLS. At the recommended airspeeds, the windmilling engine provides adequate hydraulic pressure for excellent controllability with the normal flight control system during flameout approach and landing. During landing rollout, lateral control is retained down to approximately 40 KIAS. With full elevator deflection (not normally required) or manual speedbrake extension at touchdown, normal flight controls become very stiff at approximately 80 KIAS. The manual flight control system, which must be selected in the event of engine seizure, provides adequate controllability, but the rapid control response required for high crosswind landing is lost.

LANDING GEAR AND SPEEDBRAKE ACTUATION. If flameout occurs during a precautionary approach, manual speedbrake retraction requires less than 2 seconds and causes no adverse trim changes.

NOTE

A pilot will not attempt a flameout approach until he has demonstrated his ability to make consistent successful practice high precautionary/flameout approaches. If a complete power loss occurs, the decision to make a flameout landing after recent demonstration of satisfactory practice approaches will be left to pilot discretion.

CANOPY AND WINDSHIELD FROSTING. Depending on atmospheric conditions and the altitude at which flameout occurs, some frosting of canopy and windshield can be expected. The majority of frosting will occur on the canopy, with some accumulation on the windshield side panels. The center windshield panel is electrically heated by the emergency generator when the landing gear is retracted and will remain clear during the flameout glide.

PRACTICE HIGH PRECAUTIONARY/FLAMEOUT APPROACHES

GENERAL. Every practice high precautionary approach and landing should be executed as realistically as possible. The following power settings with speedbrakes extended, closely approximate a flameout condition:

Altitude	RPM (Percent)	Rate of Descent
20,000 to 10,000	80	4500 fpm
Below 10,000	75	4100 fpm

Simulated flameout conditions should be established at varying directions and distances from the field and maintained to touchdown, or waveoff if landing is inadvisable. Skill in maneuvering the aircraft to the initial point as well as flying the approach and landing is important. If successful interception of the initial point is not possible, the practice approach should be continued to intercept the pattern at the first possible checkpoint to execute a safe landing.

Due to the high rate of descent, familiarity with the flameout condition flare characteristics and proficiency in flying the pattern must be established prior to carrying any approach below 500 feet AGL.

When making approaches to touch-and-go landings, the throttle should be reduced to IDLE during the flare to more closely simulate the flameout flare characteristics.

MINIMUM PILOT QUALIFICATIONS

1. A minimum of six satisfactory practice high precautionary/flameout approaches to a minimum altitude of 500 feet AGL shall be accomplished prior to executing an approach to touchdown. Two of these should be demonstrated just prior to touchdown.

2. A minimum of three consecutive satisfactory approaches to touch-and-go landings shall constitute qualification.

3. Following initial qualification, a minimum of two satisfactory approaches to touch-and-go landings, or waveoff, should be executed each month to maintain an acceptable level of proficiency.

4. All approaches prior to qualification shall be monitored by a qualified chase pilot.

5. A record of satisfactory approaches should be maintained for each pilot.

LOW PRECAUTIONARY APPROACH (LPA)

The low precautionary approach (LPA) (figure 5-11) may be used whenever circumstances make it desirable, such as low ceiling or visibility, loss of oil

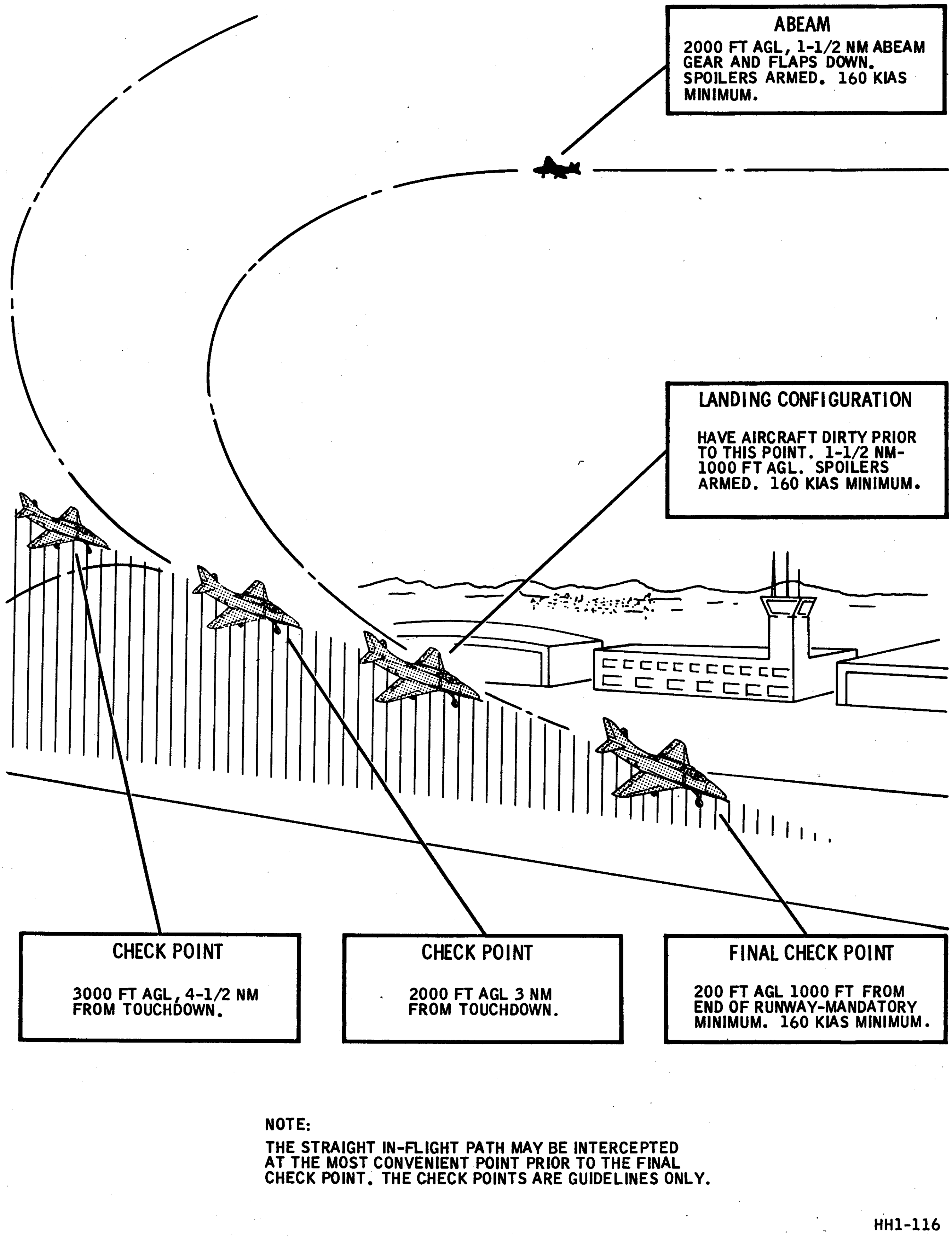


Figure 5-11. Low Precautionary Approach

pressure, or other engine difficulties which make it undesirable or impossible to reduce rpm. The variations in pattern entry and altitude allow a wide margin of flexibility. A suitable field for an LPA is one with a minimum of 8000 feet of hard-surfaced runway. Select a field with crash equipment and arresting gear, if practicable.

ENTRY. Approaches to the field for an LPA are divided into upwind or downwind categories. If upwind of the landing runway, plan to pass through a normal left or right base at 2000 feet AGL, executing a 180-degree approach, slightly steeper than a normal flight path on the final. If downwind of the landing runway, plan a modified straight-in approach to intercept the depicted flight path.

STRAIGHT-IN APPROACH. If a straight-in LPA is selected, the initial point is 3000 feet AGL at 4 1/2 miles from the touchdown point. However, the pilot may choose to intercept the depicted flight path at any desired point in landing configuration - gear down, flaps down, spoilers armed, speedbrakes as necessary. Have the aircraft "dirty" by 1 1/2 miles from touchdown, if possible. Turn the gunsight ON and set at 110 mils. At the initial point (or wherever the LPA flight path is intercepted), set the pipper on or alongside the touchdown point (1000 feet down the runway from the approach end). Hold it there and drive downhill. Use speedbrakes as necessary to maintain 160 KIAS. The rate of descent will be 1500 to 1800 feet per minute, depending on the wind.

FINAL APPROACH AND LANDING. The pilot must make his decision either to eject or continue the approach by 200 feet AGL, since this altitude represents the lowest altitude a safe ejection can be expected because of the pilot's reaction time and the attendant sink-rate. Do not descend below 200 feet AGL until 1000 feet from the end of the runway. This final checkpoint is the first point in the LPA from which a safe landing on the runway can be made if the engine fails.

Just short of the end of the runway, reduce power as necessary and land. After touchdown, secure the engine. If necessary, drop the hook 1000 feet prior to engaging arresting gear.

PRACTICE LPA'S. Practice LPA's are conducted as above. If in an airport control zone, practice LPA's will be conducted only when there is positive control of traffic. Due to the higher than normal sink-rate used in making this approach, pilots are cautioned that significant power reduction should not be made during practice approaches until the sink-rate has been reduced to a normal rate by flaring as the touchdown point is approached. It is recommended that initial practice be monitored by a chase pilot or by a qualified A-4 pilot or LSO on the end of the runway, with two-way radio communications. Always waveoff if the sink-rate gets out of control.

Landing - Use of Emergency Field Arresting Gear

There are several types of field arresting gear including the anchor chain cable, water squeeze, and Morest-type equipment. All types require engagement of the arresting hook in a cable pendant rigged across the runway. Location of the pendant in relation to the runway classifies the gear.

MIDFIELD GEAR - Located near the halfway point of the runway. Usually requires prior notification to rig for arrestment in the direction desired.

ABORT GEAR - Located 1500 to 2500 feet short of the upwind end of the duty runway and usually is rigged for immediate use.

OVERRUN GEAR - Located shortly past the upwind end of the duty runway. Usually is rigged for immediate use.

Some fields have all three types of gear; others have none. For this reason, it is imperative that all pilots be aware of the type, location, and compatibility of the gear in use with the aircraft, and of the policy of the local air station with regard to which gear is rigged for use and when.

The approximate maximum permissible engaging speed, gross weight, and offcenter engagement distance for field arrestment of aircraft are listed in figure 5-12.

WARNING

> Under no circumstances should a pilot's decision to abort a takeoff be delayed because of knowledge that an emergency arresting gear is available at the end of the runway. Decision to abort should be based on the usual parameters of remaining runway and distance required for stopping, using wheel brakes. The arresting gear will serve as an assist to stop the aircraft from rolling off the runway onto unprepared surfaces.
>
> If off center, just prior to engaging the arresting gear, do not attempt to go for the center of the runway. Continue straight ahead parallel to the centerline.

As various modifications to the basic types of arresting gear are used, exact speeds will vary accordingly. Certain aircraft service changes may also affect engaging speed and weight limitations. Severe damage to the aircraft is usually sustained if an engagement into the chain gear is made in the wrong direction.

Arresting Gear	Short Field Landing (g)		Long Field Landing		Aborted Takeoff		Maximum Offcenter Engagement (Feet)
	Aircraft Gross Weight (f)	Maximum Engaging Speed (Knots)	Aircraft Gross Weight	Maximum Engaging Speed (Knots)	Aircraft Gross Weight	Maximum Engaging Speed (Knots)	
M-2	14,500	130 (d)	16,000	130 (d)	24,500	118 (d)	20
E-14-1	14,500	147 (b)	16,000	147 (b)	24,500	152 (a)	35
E-27	14,500	157 (b)	16,000	157 (b)	24,500	160 (d)	20
E-15 (200 ft Span)	14,500	150 (b)	16,000	150 (a), (b)	24,500	145 (a)	20
E-15 (300 ft Span)	14,500	160 (d)	16,000	160 (d)	24,500	160 (d)	40
M-21	14,500	151 (a)	16,000	151 (a)	24,500	144 (a)	10
E-28	14,500	160 (d)	16,000	160 (d)	24,500	150 (a)	40
E-5 (Std Chain)	14,500	143 (b)	16,000	150 (d)	24,500	150 (d)	(e)
E-5-1 (Std Chain)	14,500	143 (b)	16,000	163 (a)	24,500	163 (a)	(e)
E-5 (Hvy Chain)	14,500	141 (b)	16,000	150 (d)	24,500	150 (d)	(e)
E-5-1 (Hvy Chain)	14,500	141 (b)	16,000	164 (a)	24,500	163 (a)	(e)
BAK-6	14,500	160 (d)	16,000	160 (d)	24,500	160 (d)	15
BAK-9	14,500	160 (d)	16,000	160 (d)	24,500	160 (d)	30
BAK-12	14,500	160 (d)	16,000	160 (d)	24,500	160 (d)	50

(a) Maximum engaging speed limited by aircraft arresting hook strength.

(b) Maximum engaging speed limited by aircraft limit horizontal drag load factor (mass item limit G).

(c) Maximum engaging speed limited by aircraft landing gear strength.

(d) Maximum engaging speed limited by arresting gear.

(e) Offcenter engagement may not exceed 25 percent of the runway span.

(f) Recommended approach airspeed for 14,500 pounds is 130 KCAS.

(g) 3.0 degree glideslope setting.

Figure 5-12. A-4E/F Field Arrestment Data

Depending upon the existing emergency condition, runway conditions, weather, time, fuel remaining, and other considerations it may be impractical or impossible to adhere strictly to the following general recommendations.

In an emergency situation, first determine the extent of the emergency by whatever means are possible (instruments, other aircraft, LSO, RDO, tower, or other ground personnel). Next, determine the most advantageous arresting gear available and the type of arrestment to be made under the prevailing conditions. Whenever deliberate field arrestment is intended, notify control tower personnel as much in advance as possible and state estimated landing time in minutes. If gear is not rigged, it will probably require 10 to 20 minutes to prepare it for use. If foaming of the runway or area of arrestment is required or desired, the pilot should request it at this time.

In general, the arresting gear is engaged on the centerline at as slow a speed as possible. Burn down to 1500 pounds of fuel or less. While burning down, make practice passes to accurately locate the arresting gear. Engagement should be made with feet off the brakes, shoulder harness locked, and with the aircraft in a 3-point attitude. After engaging the gear, good common sense and existing conditions determine whether to keep the engine running or to shut it down and abandon the aircraft.

SHORT FIELD ARRESTMENTS

If at any time prior to landing it is known that a directional control problem exists, or that a minimum rollout is desired, a short field arrestment should be made and the assistance of an LSO should be requested. Inform the LSO of the desired touchdown point. If midfield or Morest-type gear is available, it should be used. If neither is available, use abort gear. Make a flat approach, with sink rate as low as possible. Touch down on centerline, approximately 300 feet short of the arresting gear, with the hook extended. The hook should be lowered while airborne and a positive hookdown check should be made, if possible. Use an approach speed commensurate with the emergency experienced. Landing approach power will be maintained until arrestment is assured, or until a waveoff is taken. Be prepared for a waveoff if the gear is missed. After engaging the gear, retard the throttle to IDLE or secure engine and abandon aircraft, depending on existing conditions.

LONG FIELD ARRESTMENTS

The long field arrestment is used when a stopping problem exists with insufficient runway remaining (i.e., aborted takeoffs, icy or wet runways, loss of brakes after touchdown, etc.). Lower the hook, allowing sufficient time for hook to extend fully prior to engagement. Do not lower the hook too early and weaken the hook point. Line up the aircraft on the runway centerline. Inform the control tower of your intentions to engage the arresting gear, so that aircraft landing behind you may be waved off. If no directional control problem exists (crosswind, brakes out, etc.), secure the engine.

ABORTED TAKEOFF

If an aircraft takeoff must be aborted, a roll-in type engagement of all arresting gear is recommended to prevent overrun. The aircraft is cleared up to the maximum takeoff gross weight specified in the Aborted Takeoff column of figure 5-12. The data provided in the Long Field Landing column may be used for lightweight aborted takeoff, where applicable.

NOTE

The taxilight may be used in locating arresting/abort gear at night.

FIELD BARRIER

At many Air Force bases and some USN/USMC fields, there is some form of jet barrier, usually a Davis type. Compatibility of the A-4 with this type of gear has not been determined, and its use is not permitted.

Carrier Barricade Engagement

CARRIER

The barricade will be used when a normal arrestment is not feasible. Refer to section I, part 4, for the maximum aircraft gross weight for barricade engagement and the applicable Recovery Bulletin for maximum allowable engaging speed and emergency-mirror/lens settings. Such stores as empty tanks, empty rocket packs, or other lightweight inert stores will not interfere with barricade engagement; but, if torn loose, they may present a hazard to flight deck personnel. Fly a normal approach: on speed, on meatball, on centerline. Do not dive for the deck or engage the barricade while in flight. Anticipate the loss of the meatball for a short period late in the

If all gear remain UNSAFE or UP with the gear handle down, the utility hydraulic system has most likely failed. Use the preceding emergency landing gear extension procedure.

1. Main gear only unsafe, gear handle down

   a. Maintain 225 KIAS or less.

   b. If practicable, obtain visual check from another aircraft or from qualified ground personnel to determine if cause is faulty indication or that gear is actually not down and locked.

   c. Even though gear is visually determined to be down and locked, make a short field arrestment, if arresting gear is available. The engine should be kept running at IDLE after the arrestment to provide hydraulic power until the ground crew inserts the gear pins. If arresting gear is not available, make a normal landing. To ensure the gear is down and locked (unless the gear indicates DOWN after touchdown), have the ground crew install the gear pins before turning off the runway. The gear pins cannot be installed if the gear is other than safe. When slow, angle off the runway onto any paved area, if it is possible to do so without making a definite turn and there is an obvious necessity to clear the runway for other aircraft to land.

   d. If a main gear is determined to be unsafe or no visual check is possible, cycle the gear in and attempt to obtain a DOWN indication. As soon as both mains indicate down, cease cycling. The nose gear extension may require as much as 2 minutes because of back pressure in the return line, if the cause is a broken nut in the main landing gear actuating cylinder. If a visual check reveals that one or more landing gear doors or strut doors remain closed, proceed as indicated in Emergency Landing Gear Extension. If all landing gear and strut doors are open, do not use the emergency landing gear release since doing so simply unlatches the doors. If gear remains unsafe and utility hydraulic pressure is available, attempt to raise all three landing gear and proceed in accordance with figure 5-13 for the particular situation that exists.

2. Nose gear only unsafe, gear handle down

   a. Maintain 225 KIAS or less.

   b. If practicable, obtain visual check.

   c. Attempt to obtain a DOWN indication by cycling gear. If a visual check reveals that the nosegear door is not open proceed as indicated in Emergency Landing Gear Extension. If the nose gear door is open, do not use the emergency landing gear release since doing so simply unlatches the landing gear door. If the gear remains unsafe and utility hydraulic pressure is available, attempt to raise all three landing gear and proceed in accordance with figure 5-13 for the applicable situation.

   d. If unable to get a DOWN indication by cycling, obtain visual check by other aircraft or by qualified ground personnel.

   e. Even though the gear is visually determined to be down and locked, make a short field arrestment, if arresting gear is available. The engine should be kept running at IDLE after the arrestment to provide hydraulic power until the ground crew inserts the gear pins. If arresting gear is not available, make a normal landing. To ensure that the gear is down and locked (unless the gear indicates DOWN after touchdown), have the ground crew install the gear pins before turning off the runway. The gear pins cannot be installed if the gear is other than safe. When slow, angle off the runway onto any paved area, if it is possible to do so without making a definite turn and there is an obvious necessity to clear the runway for other aircraft to land.

   f. If unable to obtain a DOWN indication or a visual check and cycling proves ineffective, proceed as indicated in figure 5-13 for the particular situation which exists.

3. For in-flight checking of the main gear in the down-and-locked position, a high-visibility fluorescent red-orange paint stripe is applied to the inboard side of the main gear drag link in two places. When these stripes are lined up, the gear is down and locked. A more positive check that the main gear is down and locked is observing that the overcenter lever at the midpoint of the drag links is positioned forward and parallel to the lower surface of the wing. The nose gear should be checked down and locked by visually sighting through the ground safety-pin hole. If for any reason a visual check is not possible and one or more landing gear indicate UP or UNSAFE with the landing gear handle down, and all other attempts to lower the gear have failed, an attempt should be made to lower the gear with the emergency landing gear release system. If the gear remains unsafe and utility hydraulic pressure is available, attempt to raise all three landing gear and proceed in accordance with figure 5-13 for the applicable situation.

4. If the landing gear does not indicate down and locked with the gear doors extended, slowly increase airspeed up to a maximum of 350 knots to obtain a down and locked indication. Particular attention must be made to keep aircraft in balanced flight.

LANDING – NO FLAPS

If unable to extend flaps for landing, fly optimum attack angle. Optimum is 10 to 15 KIAS above

full-flap approach speed. Fly slightly wider pattern at about 1 1/2 miles abeam. For shipboard recovery burn-down or dump-down fuel to 13,000 pounds maximum gross weight to avoid exceeding maximum engage speed.

LANDING – NO SPEEDBRAKES

Utilize the standard pattern entry, approach, and landing when making a no-speedbrakes approach. The airspeed will be more sensitive to changes in the nose position. In the event of a waveoff, acceleration time to 100 percent will be slightly longer, but the overall difference from a speedbrake pass is negligible.

LANDING – STUCK SLAT

Fly optimum angle of attack. If angle of attack is not available, add 10 knots to the normal approach speed. Trim out any adverse lateral-control pressures. Be alert to apply prompt correction, should the slat extend during the approach. Aboard ship, observe the maximum engaging speed.

LANDING – SPOILER MALFUNCTION ON LANDING ROLL

The spoilers are not interconnected; therefore, there is a remote possibility that only one spoiler will be actuated if a spoiler malfunction occurs. The pilot will notice an immediate swerving tendency, which can be controlled by application of corrective rudder, brakes, and aileron, as required. When control of the aircraft is regained, place the spoiler switch in OFF. The flaps should be raised as soon as possible.

NOTE

The spoilers are inoperative during use of emergency generator or following loss of utility hydraulic pressure.

LANDING WITH ASYMMETRIC LOAD

With asymmetric loads, landing should be made upwind or downwind, whichever is required to put the crosswind component under the heavy wing, providing other factors are considered; runway length, gross weight, and appreciably shortened rollout by securing the engine. Make a long straight-in approach. Execute a steady heading sideslip (wing down, opposite rudder) during approach by applying rudder in the direction of the heavy wing to move internal wing tank fuel to the opposite wing, which will help balance the asymmetric load. The minimum approach speed is 115 knots with up to 7500 foot-pounds of asymmetric moment, varying linearly thereafter to 130 knots at 12,500 foot-pounds. Normal approach angle of attack should be maintained as long as the resulting airspeed does not become less than the minimum. On manual control with asymmetric moments up to 7500 foot-pounds, the initial approach speed should be a minimum of 140 knots, with a minimum final approach and touchdown speed of 125 knots. Landings on manual control with asymmetric moments greater than 7500 foot-pounds are not recommended. With asymmetric loading, the maximum 90-degree crosswind component under the loaded, or heavy wing, is 15 knots without spoilers and 25 knots with spoilers up.

Landing with any amount of crosswind under the unloaded, or light wing, is not recommended due to a considerable reduction in control capability and possible unsafe characteristics during rollout.

LANDING – MANUAL FLIGHT CONTROL (HYDRAULIC POWER DISCONNECTED)

With the flight controls disconnected and all other systems operative, a modified approach with a long straightaway should be utilized. If the utility hydraulic system is inoperative, modify the approach as specified for landing with no flaps. Maximum recommended crosswind component for landing is 8 knots. Above 8 knots, an arrested landing is recommended.

LANDING – MANUAL FLIGHT CONTROL – ASYMMETRIC LOADING (HYDRAULIC POWER DISCONNECTED)

Hydraulic power disconnects should not be performed with asymmetric loadings. If an actual hydraulic power disconnect must be made with asymmetric wing or store loadings, the following is recommended:

1. Speed must be reduced to less than 200 KIAS prior to disconnecting.

2. After disconnect, excessive longitudinal stick motions must be avoided.

3. Crosswind landings must be made upwind or downwind, whichever is required to put the crosswind component under the heavy or loaded wing.

4. Recommended approach airspeed is 140 KIAS with minimum final approach and touchdown airspeed of 120 KIAS. Minimum recommended lateral control speed is 115 KIAS with hydraulic power failure and up to 7500 foot-pounds asymmetric moment.

LANDING – NO AIRSPEED INDICATION

Landing with the airspeed indicator inoperative can be accomplished safely. The angle-of-attack indicator/indexer should provide the pilot with a safe landing approach attitude reference. The wing slats, when halfway out with gear and flaps down, will also serve to indicate a safe landing approach speed.

LANDING WITH RUNAWAY NOSEDOWN TRIM

If a landing must be made with full NOSEDOWN trim which cannot be corrected by using the horizontal stabilizer MANUAL OVERRIDE, proceed as follows:

1. Burn down to 1000 pounds fuel remaining.

2. At a safe altitude, place aircraft in landing configuration. Wing flaps should not be extended.

approach, as the barricade stanchions may obscure the mirror.

Approach light indications will not be available to the LSO with the landing gear retracted nor will indexer indications be available for the pilot.

Landing With Landing Gear Malfunctions

Figure 5-13 furnishes course of action guidance for emergency landings with landing gear malfunctions. These are recommendations only and are based on experience and statistical data available to date. It is recognized that sea, deck, weather, operational and pilot considerations may indicate different actions. The general considerations which follow are pertinent.

FIELD ARRESTMENTS

Always request the assistance of an LSO. When the arrestment is to be made at night, have the arresting gear position illuminated. If the landing must be made with fuel in the wing or external tanks, it is recommended that the intended landing area be foamed. Do not land wheels-down in "abort" type gear unless enough runway remains for runout. Normally, 1500 feet should be adequate.

Landing - Other Failures

NO UTILITY HYDRAULIC PRESSURE

Intermittent illumination of the utility system ladder light will usually warn the pilot of the impending loss of utility system pressure prior to the complete loss of pressure. When this is observed and it is practical to do so, slow the aircraft and lower the landing gear and flaps, placing the flap-selector in the STOP (center) position after extension. Return to base and land. Be prepared to disconnect the flight control power mechanisms in the event the flight control hydraulic system should also fail. (Refer to Hydraulic Systems Failure.)

It is not practical to dirty-up because of fuel considerations; slow to 300 KIAS or below. Return to base or an alternate field. Lower the wheels, using the emergency landing gear extension procedure set forth in this section. Wing flaps and speedbrakes will not be available unless extended and locked prior to utility system failure. Spoilers will be inoperative. Nosewheel steering control switch should be placed in the EMER OFF position. Landing gear safety pins should be installed as soon as possible after landing.

The wheel brakes hydraulic system is completely independent of the aircraft hydraulic system. Because the system is separate, the pilot will have wheel brakes available even though he makes a field landing with aircraft hydraulic system failure. In addition, should the aircraft have such a failure, the pilot can extend the arresting hook. Compressed air pressure and arresting hook weight cause the hook to extend when the HOOK handle is moved to the DOWN position. However, the arresting hook cannot be retracted without aircraft hydraulic system pressure.

When making a field landing with aircraft hydraulic system failure, the arresting hook should not be extended in flight. Wheel brakes should be sufficient to stop the aircraft. If the arresting hook is required as a last resort measure, it should not be extended until 1000 feet prior to engagement. Dragging the hook on the runway unnecessarily could cause it to be damaged to the extent of complete failure.

EMERGENCY LANDING GEAR EXTENSION

Utility hydraulic system failure will necessitate lowering the landing gear with the emergency release system as follows:

1. Airspeed . . . . 130-225 KIAS
2. Landing gear handle . . . . DOWN
3. Emergency landing gear release . . . . pull
4. If the landing gear does not extend fully or lock down, increase the airspeed and apply positive "g" loading in an attempt to get gear-down indication.

After lowering the landing gear by the emergency release system, the gear handle should be left in the DOWN position until the ratchet in the emergency system has been reset and cavitation in the geardown hydraulic pressure line has been eliminated by the application of hydraulic power. This procedure should be followed to prevent a failure of the ratchet and damage caused by premature closing of the gear doors. However, if utility system pressure is available and circumstances warrant, the landing gear can be raised by means of the landing-gear handle.

UNSAFE GEAR INDICATIONS

The most likely causes of failure of the landing gear to indicate DOWN after completion of the gear extension cycle are faulty microswitches, sticking gear-position indicator, utility system hydraulic failure, or failure of the main landing gear actuating cylinder.

FINAL CONFIGURATION	CARRIER		FIELD Arresting gear available			FIELD No arresting gear	
	Land or Eject?	Notes	Land or Eject?	A/G Used?	Notes	Land or Eject?	Notes
All gear up	LAND	1	LAND	Yes	3,4	LAND	3
Nose gear up	LAND	1,2	LAND	Yes	5,6	LAND	5,8
Stub-nose gear	LAND	1	LAND	Yes	5,6	EJECT	
One main gear up	LAND	1	EJECT	No	7	EJECT	
Stub-main gear	LAND	1	EJECT	No		EJECT	
One main gear up; Nose gear up	EJECT		EJECT	No		EJECT	
Both main gear up	EJECT		LAND	Yes	5,9	LAND	5,9

General:

Whenever any landing gear is damaged or not down and locked, but all gear can still be retracted, retract gear and divert ashore if feasible. Retain and land on empty tank(s), empty rocket packs, or other lightweight inert stores, with exception of air refueling store. Jettison drop tanks, if they cannot be emptied. Prior to landing with any of the above malfunctions, burn down to 1500 pounds or less fuel remaining, to ensure that wing fuel is expended and fire hazard minimized.

Notes:

1. Crossdeck pendant configuration shall be in accordance with current recovery bulletin.

2. If time considerations preclude the removal of cross-deck pendants, land with the hook up to prevent severe nosedown rotation, should arrestment occur prior to barricade-engagement.

3. Preferred method: Land into the arresting gear on a foamed runway under LSO control. If arresting gear is not available, landing on a foamed runway is recommended. In both cases, fly a flat approach at normal approach speed. Touch down lightly at a minimum sink rate.

4. Alternate method: Use arresting gear without foaming runway. Wave off if wire is missed.

5. Burn down to 600 pounds prior to landing.

6. Make a short field arrestment from a flat approach at normal approach speed. Trim full NOSE-UP approaching touchdown. At touchdown, do not retard throttle. Hold nose up until arrestment. Wave off if the wires are missed.

7. An alternative to ejection for this condition is to land in an approach similar to that in Note 6, except slightly fast and with the touchdown point immediately prior to the arresting gear. Grease this one on holding the wings level with the stick as long as possible. An LSO is probably a necessity for this situation unless the gear location is prominently marked.

8. Make a flat approach at normal approach speed. Trim full NOSE-UP approaching touchdown. At touchdown, secure the engine. Lower the nose slowly before elevator effectiveness if lost.

9. Ejection mandatory without two drop tanks installed.

Figure 5-13. Guide to Emergency Landings With Landing Gear Malfunctions

3. Cautiously reduce airspeed to a reasonable approach speed commensurate with the runway length available for stopping. The airspeed selected should also provide 2 inches of additional backstick for use if gusts or turbulence cause a nosedown pitch during the approach. Landing may be made as soon as the above conditions are met. At 600 pounds fuel remaining, CG should have moved aft far enough to provide the requisite 2 inches excess backstick at optimum approach speed ("donut") with the flaps retracted. Extending the flaps will reduce the amount of backstick available.

LANDING WITH RUNAWAY NOSEUP TRIM

Make a normal approach and landing with full flaps. A moderate amount of forward stick pressure will be required at normal approach speed.

LANDING – KNOWN BRAKE FAILURE

Landing with one or both brakes inoperative should be accomplished as follows. If arresting gear is available, make a short field arrestment, preferably into the midfield gear. Be prepared to wave off if the arresting gear is missed. If arresting gear is not available, land wheels-up on empty tanks, racks, or lightweight inert stores.

When landing aboard ship with a known brake failure, do not reduce power below 80 percent; leave hook down and engaged with cross-deck pendant until towbar and tractor have been connected to aircraft.

LANDING – BRAKE FAILURE AFTER TOUCHDOWN

When a brake failure occurs after touchdown, wave off if possible and proceed as described in Landing – Known Brake Failure. If unable to wave off and arresting gear is available, maintain directional control with rudder and make an arrested landing.

Prudent use of nosewheel steering (all A-4F aircraft) may be desirable at slower airspeeds. The aircraft should be straight on centerline at least 1000 feet prior to the arresting gear when the hook is lowered. The nosewheel will center and lock as the hook is lowered, and steering ability will be reduced. On A-4F aircraft reworked per A-4 AFC 429, nosewheel steering may be maintained while the hook is lowered by pressing nosewheel tailhook bypass switch (figure 1-9A).

When arresting gear is not available and waveoff is not feasible, a decision to jettison flammable stores, retract landing gear, and shut down the engine must be made if the aircraft is not going to remain on the runway. Ejection is a feasible alternative.

LANDING – NOSEWHEEL STEERING FAILURE
Effectivity: All A-4F aircraft

If there is indication of loss of control in nosewheel steering, immediately release stick control button. Regain control of aircraft with rudder and brakes as necessary, and switch nosewheel steering to EMER OFF.

LANDING WITH BLOWN MAIN TIRE

Little difficulty should be experienced in landing with a blown main tire. If it is known prior to landing that the tire is blown, a short field arrestment is recommended. If there is no arresting gear available, secure the engine after touchdown to minimize landing roll. In crosswind conditions, always use the arresting gear, if available. Land on the left, right, or center of the runway; depending on crosswind and which tire is blown. For instance, with the left tire blown, a crosswind from the right, and no arresting gear available, land on the right side of the runway to provide the maximum distance for arcing to the left. In this case, both wind effect and the increased drag of the blown tire are additive, tending to drift the aircraft across the runway to the left. If the tire blows during normal landing rollout, use full rudder, if necessary, and brakes as required to maintain directional control. Usually, a blown tire will not even be noticeable until 80 knots or less. If the stopping distance appears marginal, secure the engine. If the use of abort or overrun gear becomes apparent, drop the hook 1000 feet prior to engagement. More braking effectiveness can be obtained from a good tire than a blown one; consequently, it is poor technique to intentionally blow the good tire. In A-4F aircraft, nosewheel steering may be used below 60 knots to maintain directional control.

LANDING WITH BLOWN NOSE TIRE

When landing with a blown nose tire, a short field arrestment is recommended. Obtain a positive hook-down check with the tower or the LSO. Make practice passes, burning down to 600 pounds for the final pass to provide an aft CG. Make a flat approach at normal approach speed. Trim full NOSE-UP just prior to touchdown. Touch down with minimum sink-rate and hold the nose off until passing over the wires. Do not retard the throttle below approach power setting until the arrestment is felt. Wave off if the wires are missed. If there is no arresting gear available, fly the same type of approach, secure the engine on touchdown, and lower the nose gear slowly before elevator effectiveness is lost. Little difficulty should be experienced with this landing, with or without arresting gear available.

Landing at High Gross Weights

Occasionally, the problem will arise of landing at a gross weight in excess of the recommended maximum, due to emergencies, fuel transfer problems, etc. Ashore, the problem is simply one of stopping, since the sink speed at touchdown can be minimized; and the stopping distance may be reduced by increased braking, securing the engine, and/or using the arresting gear.

A flat approach using optimum AOA will be maintained to avoid high rates of descent and excessive airspeed. Final approach speed is critical and once the runway is definitely made, power and attitude should be adjusted to touch down with a minimum rate of descent. Landings are recommended only in day VFR conditions onto runways of 10, 000 feet or more, utilizing a straight-in approach.

Aboard ship, if it is necessary to make a heavy landing, the most important consideration is to keep the sink speed to a minimum. If time permits, the mirror should be changed to a 3. 5-degree glide slope in accordance with the recovery bulletins. Diving for the deck would be very bad procedure. The angle-of-attack indexer will show the best approach speed for the weight and should not be exceeded. If the downwind leg angle-of-attack check results in a high airspeed, it is best to fly the high airspeed rather than conclude that the angle-of-attack system is in error. There may be fuel in the tanks or in the buddy store, or there may be hung ordnance of which the pilot is not aware. If a gross discrepancy exists, inform the LSO, who can tell by the aircraft attitude and the SPN-12 reading which instrument is correct. Another important point is to land wings-level and on the centerline. A late lineup correction may result in a collapsed landing gear. Landings in excess of the maximum gross weight recommended in section I, part 4, or the applicable Recovery Bulletin, should be made only in an emergency, as the structural limits of the landing gear or arresting hook may be exceeded.

Forced Landings

LANDING ON UNPREPARED SURFACES

Landing on unprepared terrain is extremely hazardous. If sufficient altitude is available, ejection is preferable to attempting an emergency landing on any surface other than a runway. When power is available, more deliberation can usually be given to evaluating the many variables affecting a safe emergency landing, such as direction and speed of the wind, and the type of surface or terrain on which the landing is to be made. On areas other than prepared runways and surfaces of shown adequate hardness, the landing should always be made with the wheels retracted. If the nature of the emergency is such that all wheels will not fully extend, the landing gear should be left in the retracted position. Prior to any wheels-up landing on prepared surfaces, all external stores should be jettisoned, except empty drop tanks and lightweight inert stores which help absorb the force of the landing. The oxygen mask should be left on during crash landings, and a decision to jettison or retain the canopy should be made prior to impact. Remain braced until the shocks stop. Use normal approach speeds throughout the landing pattern and attempt to touch down at, or slightly above, the normal landing speed.

EMERGENCY EXIT

Three methods for emergency exit are given, the choice of which depends on the emergency condition. Method 1 is recommended only under extreme emergency conditions in A-4F aircraft where circumstances clearly indicate immediate exit. Methods 2 and 3 are recommended only if time permits.

METHOD 1. (All A-4F) Eject. Refer to Ejection procedures.

METHOD 2. This method may be used when the pilot elects to exit without his parachute and survival gear.

a. Jettison canopy by pulling CANOPY JETTISON handle.

NOTE

> The canopy can be jettisoned with the cockpit normal canopy control handle in any position.

b. Unfasten the four parachute harness fittings.

c. If time permits, disconnect oxygen hose. Hose fittings will automatically disconnect when approximately 20 pounds force is applied to the fittings.

d. If time permits, safety ejection controls by pulling safety handle on pilot's headrest to DOWN and LOCKED position. This will prevent inadvertent ejection of the seat.

e. Exit from aircraft.

METHOD 3. This method may be used when the pilot elects to exit with his parachute and survival gear attached. However, it is not recommended when the height of the jump to the ground may result in injury which would prevent the pilot from moving a safe distance from the aircraft. Also, retaining the parachute and survival kit unduly restricts body movement, consequently compromising quick exit from the cockpit.

a. Jettison canopy by pulling CANOPY JETTISON handle.

b Pull harness release handle to release pilot from seat with parachute and survival gear attached.

c. If time permits, safety ejection controls by pulling safety handle on pilot's headrest to DOWN and LOCKED position. This will prevent inadvertent ejection of the seat.

d. Exit from aircraft.

EMERGENCY ENTRANCE

When it is necessary to gain entrance to the cockpit in an emergency, it may also be necessary to effect the quick and safe removal of the pilot from his seat and parachute. This entry-and-rescue operation requires that certain procedures be followed and that certain precautions be taken. (See figure 5-14.)

An external control for jettisoning the canopy is provided on each side of the fuselage. Push in on the rescue-access door and PULL the red canopy-jettison handle that extends. This action will jettison the canopy if it is closed and locked.

WARNING

- When the canopy is jettisoned, the seat-catapult interlock is extracted and care should be taken to avoid firing the seat-catapult charge.
- Pull ejection safety-handle down prior to removal of pilot from seat.

To release the pilot from the seat without the parachute and survival equipment attached, unfasten the harness fasteners (four places) and disconnect the pilot's oxygen hose from the seat-pan oxygen hose. Pulling the harness-release handle releases the pilot from the seat with the parachute and survival equipment attached.

Ditching

DITCHING AT SEA

A forced landing at sea should be made only as a last resort. Ejection is recommended whenever possible. Whenever possible, ditch while power is still available.

If power is not available, the pilot must necessarily choose between a high sink-rate or increased speed, both extremely dangerous approaches to the water. Moreover, the pilot has the difficult problem of determining exactly how high to flare above the water without stalling, often without any visual references to assist in height determination.

As many as possible of the following should be accomplished if ditching is imminent:

1. Shoulder harness . . . . LOCKED
2. Landing gear . . . . UP
3. External stores. . . . . JETTISON
4. Wing flaps . . . . DOWN
5. Seat . . . . MIDPOSITION
6. IFF. . . . . EMERGENCY
7. Transmit MAYDAY position report.
8. Helmet visor . . . . DOWN
9. Emergency oxygen (just before touchdown). . . . . PULL
10. All armament switches. . . . . SAFE
11. Air-conditioning switch . . . . RAM
12. Canopy. . . . . JETTISON
13. Arresting hook DOWN to "feel" for the water.

In light seas without swells, land into the wind. Land along the top of, and parallel to, the swells, if they are large roller-swells and if the wind is less than 25 knots. Land into the wind in higher-force winds to take advantage of the lowered forward speed, but recognize the possibility of ramming a wave or of striking the tail on a wave crest and nosing in. Maintain sufficient airspeed to flare the aircraft just before touchdown. DO NOT STALL. Remain braced until all shocks stop. If not previously accomplished, jettison canopy. Pull harness-release handle to separate from seat with survival gear, and abandon the aircraft as soon as possible.

UNDERWATER ESCAPE

In the event of submersion from porpoising, remain braced until all shocks stop. Keep the oxygen mask on. Jettison the canopy. In the event of malfunctioning of the canopy-jettison system, the pilot can open the canopy, using the manual canopy-control handle. Use the harness-release handle to disconnect from the seat and to retain the survival gear. Disconnect the oxygen hose from console. Lean forward to clear the parachute past the headrest and to ensure separation of the shoulder-harness fitting. Pull with the hands on the upper edge of the windshield-bow and push with the feet to escape.

In extreme circumstances, the pilot has two other methods of getting through the canopy. The first method is to crack the canopy open, using either his service revolver or his survival knife. The use of the revolver should include having the helmet and

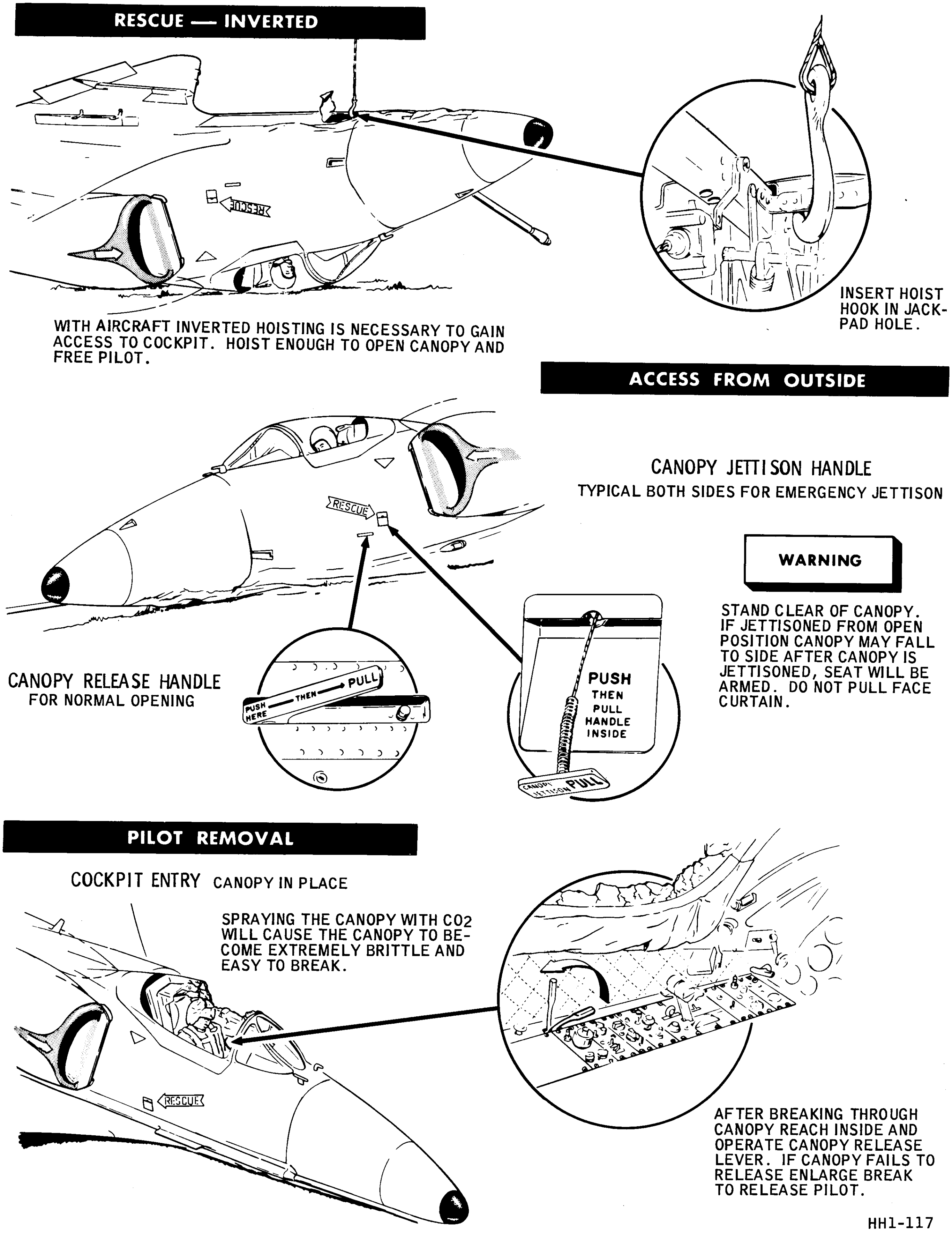


Figure 5-14. Emergency Entrance

oxygen mask on, with the helmet visor down over the eyes and as much of the body as possible covered for protection from flying plexiglass. The revolver must not be fired if immersed in water. It has been found possible to crack the plexiglass with the survival knife by holding the knife with both hands, the blade pointing up, and striking the canopy above the head with the point of the knife.

During an underwater escape, the survival gear should be retained. The second method is to attempt to exit by releasing the quick-disconnect fittings which will also require manually disconnecting the pilot-to-seat-pan oxygen/communication connection on the torso harness. Because this method requires breaking five connections, it is recommended that the survival gear be retained. Also, much buoyancy can be gained from the survival gear. Releasing the lower left quick-disconnect fitting prior to surfacing should prevent head-down flotation.

The aircraft is equipped with an UNDERWATER CANOPY-JETTISON RELIEF VALVE, designed to facilitate removal of the canopy under water. It is recommended, however, that the canopy be jettisoned by pulling the canopy-jettison handle prior to submersion.

UNDERWATER ESCAPE PROCEDURE

1. Remain braced until all shocks stop.

2. Emergency oxygen . . . . PULL

3. Oxygen hose (left console) . . . DISCONNECT

4. Canopy jettison handle . . . . . . PULL

5. Harness-release handle . . . . . PULL

6. Lean forward to separate the harness linkage and clear the parachute past the headrest and to ensure separation of the shoulder harness fitting.

7. Pull forward with the hands on the top of the windshield bow and push with the feet.

WARNING

Do not inflate flotation gear until clear of cockpit as inflated gear may trap the pilot in cockpit.

8. When clear of the cockpit, inflate flotation gear.

It is recommended that pilots periodically practice exiting from the cockpit with the parachute and para-raft to ensure separation from the seat and clearing the headrest. The canopy should not actually be jettisoned in practice. Proper oxygen mask fit will prevent water from seeping in during the critical underwater escape.

SECTION VI
ALL-WEATHER OPERATION

TABLE OF CONTENTS

ALL-WEATHER OPERATION

General

Discussions of special techniques and procedures for operation in adverse weather necessarily includes some instructions found in other sections of this handbook. Operating instructions covered in this section will be repeated only to establish the correct sequence of operations or to emphasize the importance of certain procedures. Any discussion concerning systems operation will be found in Section I. The NATOPS Instrument Flight Manual should be used in conjunction with this section.

INSTRUMENT FLIGHT PROCEEDURES

This section presents certain characteristics and limitations of the aircraft during instrument flight conditions as a supplement to previous training and experience. Successful fulfillment of a mission under instrument flight conditions requires careful preflight planning, current instrument proficiency on the part of the pilot, and adequate instrumentation for climbout, cruise, and approach. The UHF receiver-transmitter provides static-free communication and works in conjunction with the UHF homing adapter receiver (automatic direction finding equipment). The TACAN operates in conjunction with surface navigation beacons to provide continuous directional and distance information to the pilot.

Instrument Takeoff

PRIOR TO TAKEOFF

To reduce fuel consumption, complete as much as possible of the pretakeoff check before starting the engine.

1. Connect external source of electrical power.
2. Check all communications and navigation equipment for correct operation.
3. Switch IFF to NORMAL.
4. Set navigation equipment on local channel so that an immediate heading indication is available if an emergency develops after takeoff.
5. Check cockpit lighting and set as low as possible in order to retain night vision. Adjust the forward floodlights for use in reading instrument flight guides, maps, etc.
6. Check oxygen supply and oxygen mask fit.
7. Set the altimeter and record the altimeter error (if any) to insert at destination.
8. Adjust the all-attitude indicator.
9. Set clock.
10. Make mandatory autopilot preflight checks.

11. Check for proper operation of all directional instruments while taxiing.

12. Check that canopy is closed.

13. Complete normal checklist.

14. Review the procedure used to jettison stores during a takeoff emergency.

TAKEOFF

When in takeoff position and lined up with the runway:

1. Check compass SLAVED and in sync.

2. Check all-attitude indicator for correct operation.

3. Turn on engine anti-icing/pitot heat switch as required. Do not prolong pitot heat use on the ground.

4. Advance throttle, maintaining directional control with brake until rudder control is effective (approximately 70 knots).

5. When takeoff speed is reached, lift nose gently from the ground to prevent an excessively high angle of attack.

6. When aircraft is well clear of the ground, raise the gear.

7. Raise flaps 170 KIAS minimum, wings level.

Basic Instruments

The procedures to be used in performing basic instrument maneuvers in the A-4E/F are discussed in the following paragraphs.

CLIMB SCHEDULE

Climb schedule for basic instrument flights will be 310 KIAS to 0.72 IMN to 240 knots minimum at higher altitudes.

SPEED CHANGES

1. To reduce airspeed, reduce power to approximate power setting necessary for airspeed desired and extend speedbrakes. Retract speedbrakes 5 knots above desired airspeed. During transition, retrim aircraft as necessary.

2. When increasing airspeed, advance power to MILITARY. When desired airspeed is attained, reduce power to approximate power setting necessary to maintain desired airspeed and altitude.

TURNS AND REVERSALS

1. Turns and reversals will be performed at 300 knots. At bank angles steeper than 30 degrees, it will be necessary to advance throttle to maintain airspeed.

2. Banks used will be 30, 45, and 60 degrees.

3. Turns will be made in both directions with each of the above angles of bank. Turns will be maintained for twice the number of degrees as the angle of bank. (For a 30-degree bank, turn right or left for 60 degrees of turn; for a 45-degrees bank, turn right or left for 90 degrees of turn, etc.)

VERTICAL S-1 PATTERN

1. The pattern describes a "W" in that it is a series of descents and climbs of 1000 feet of altitude, while maintaining constant airspeed and heading.

2. The pattern will be performed at 250 knots in a clean configuration with speedbrakes IN.

3. Rate of descent will be 1000 fpm and should be timed with the clock. It will be necessary to lead all transitions by 5 seconds.

VERTICAL S-2 PATTERN

1. A vertical S-2 pattern is similar to the vertical S-1 pattern, except that a constant one-half standard-rate turn is maintained throughout the pattern.

2. After 1 minute, the pilot should have lost 1000 feet and turned 90 degrees. At the end of the second minute, he should have climbed 1000 feet and turned 180 degrees. After the third minute, he should have descended 1000 feet and turned through 270 degrees. After the fourth minute, he should have climbed 1000 feet, bringing him back to the original heading and altitude.

VERTICAL S-3 PATTERN

The vertical S-3 pattern is similar to the S-2 pattern, except that the turn is reversed after 180 degrees of turn.

YANKEE PATTERN

Figure 6-1 is a diagram of the Yankee Pattern.

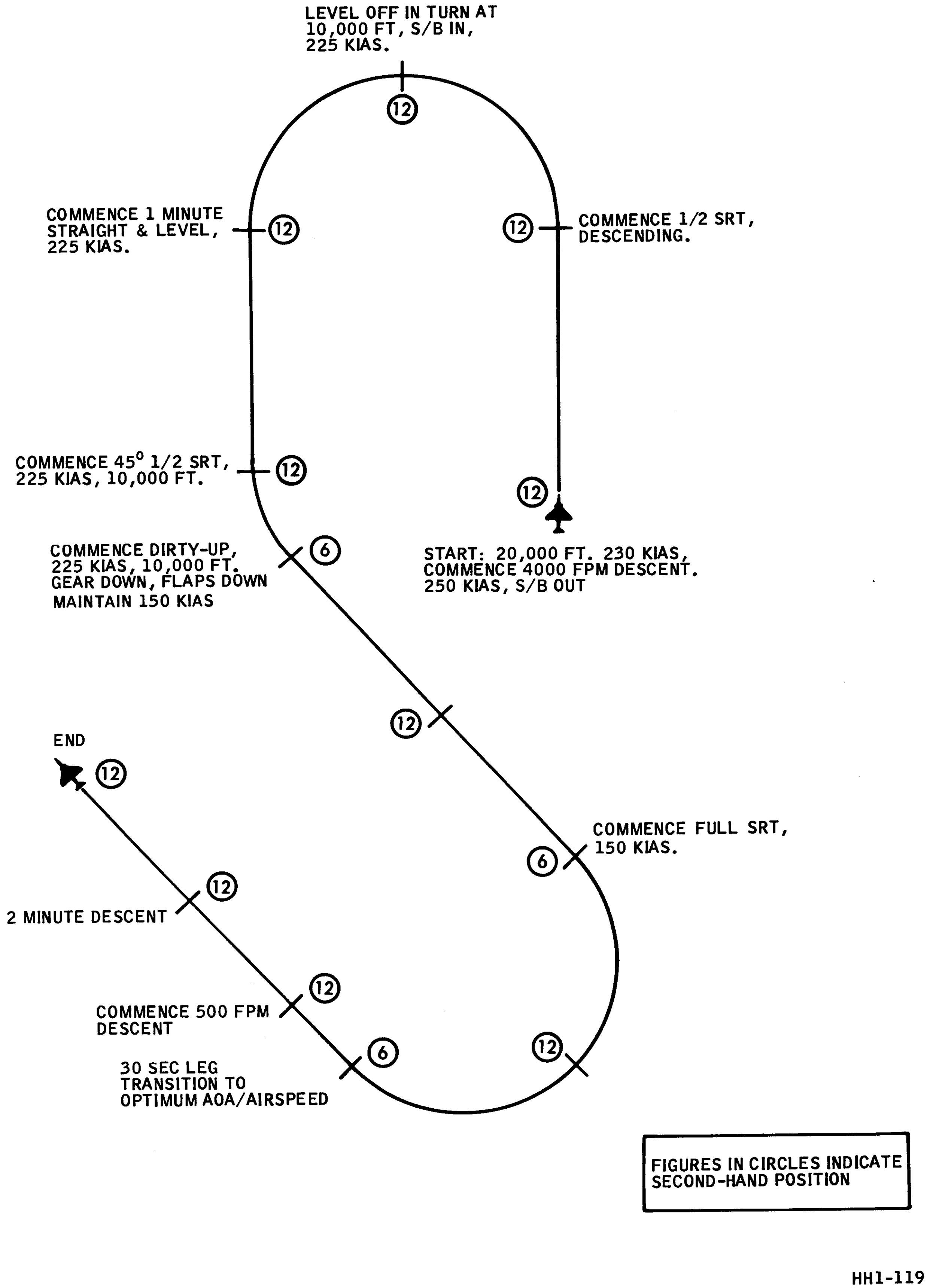


Figure 6-1. Yankee Pattern

HOODED INSTRUMENT FLIGHT

Hooded instrument flight will not commence until radio communications have been established with the safety pilot and an altitude of 2000 feet AGL has been obtained.

JET PENETRATIONS

A penetration is a maneuver which combines a high rate of descent with a constant airspeed and maintains the aircraft within a specified airspace. It is designed to minimize fuel consumption and the effects of turbulence, icing, and wind; and serves to place the aircraft in position for a low approach. Prior to commencing a penetration, the following checklist should be completed.

1. Air conditioning . . . . . . HOT
2. Windshield defrost . . . . INCREASE
3. Altimeter . . . . SET
4. Shoulder harness . . . . LOCKED
5. Engine anti-icing pilot heat . . . . AS REQUIRED

CLEAN PENETRATION. The clean penetration is conducted at 250 KIAS, speedbrakes OUT, and at a rate of descent of 4000 to 6000 fpm. Clean penetration will require an initial power setting of about 80 percent. At penetration fix and 230 KIAS, the nose is lowered to approximately 7 degrees nosedown to start penetration. As airspeed reaches 245 KIAS, speedbrakes are extended. Maintain 250 KIAS and adjust power as necessary to maintain 4000 to 6000 fpm rate of descent. It is vital that the pilot be conscious of the aircraft's approach to each even 10,000-foot level to preclude misreading of the altimeter by 10,000 feet.

In the event of low-fuel state, a penetration can be accomplished, utilizing IDLE rpm and speedbrakes IN. Maintain 250 KIAS and adjust power as necessary to provide 4000 to 6000 fpm rate of descent. Windshield may frost up during this type of descent due to reduced defrost air circulation.

Start transition to level flight about 1500 feet above the desired altitude. There is a tendency to lose altitude after bottoming out of the penetration and "dirty-up" which can be avoided by leading with adequate power. At level-off during single-aircraft approaches, slow to and maintain gear-down speed. Gear and flaps shall be lowered in order to reach the "gate" in a landing configuration at desired approach speed.

DIRTY PENETRATION. The "dirty" penetration is recommended when one member of the flight has radio and/or NAVAIDS failure and it is necessary to penetrate in section to a minimum ceiling. "Dirty-up" is accomplished "VFR on top." When performed at night, the lead aircraft will keep his lights on BRT/STDY and his fuselage/anticollision light OUT. The controlling agency must be advised of the airspeed deviation prior to initiating this type of penetration.

The "dirty" penetration is performed at 170 KIAS, wheels and flaps DOWN, speedbrakes OUT, and at a rate of descent of 3000 to 5000 fpm. Just prior to reaching initial penetration fix, slow to 225 KIAS and drop wheels and flaps. Upon reaching the fix, reduce throttle to 80 percent, drop the nose about 7 degrees below the horizon, and extend the speedbrakes. Maintain 170 KIAS. Start transition to level flight about 1500 feet above the desired altitude.

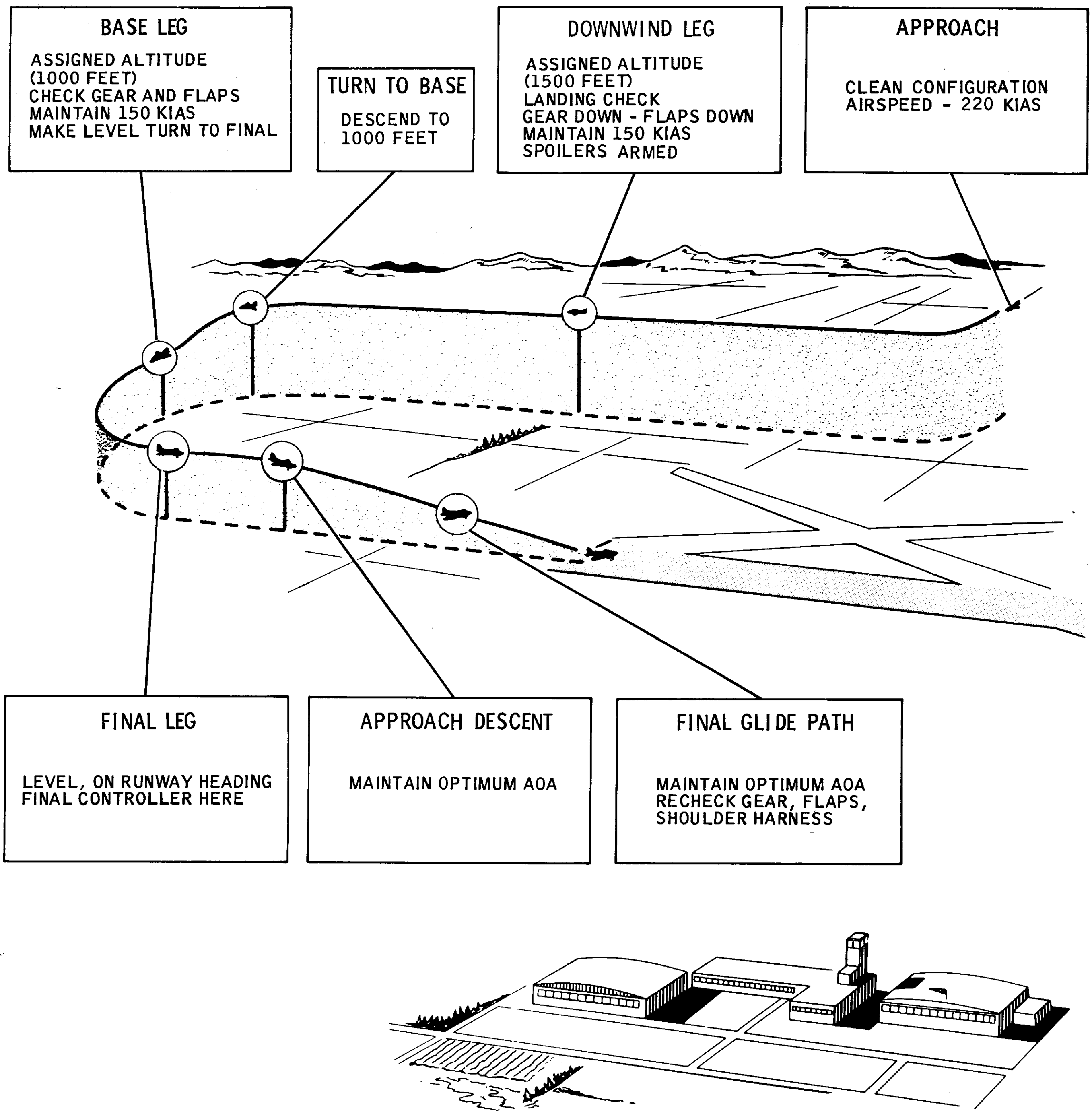
GROUND-CONTROLLED APPROACH (GCA)

Achieving the precision necessary to make successful GCA's to minimums will require practice, alert flying, and smooth, coordinated control of power, attitude, and altitude. Turns in the pattern will be standard rate, with the following exceptions:

1. Do not exceed 30-degrees bank.
2. Do not exceed 15-degree bank on final approach. Use positive rudder control in all turns.

The relatively small reflecting surfaces of the A-4 design may make it difficult, when precipitation is heavy, for the GCA controller to pick up the aircraft with radar for an initial entry. The pilot can assist the pickup by extending speedbrakes and landing gear higher in the pattern, until identified. Then he should go back to the normal GCA procedure. A typical GCA for the aircraft is shown in figure 6-2.

GLIDEPATH. Prior to descent down the glidepath, complete landing checklist. Assuming that the airspeed has been properly adjusted to final approach speed prior to reaching the glidepath, the following entry procedure will be used: When the controller says "You are approaching glidepath, commence standard rate of descent," DO NOT commence descent. When the controller says "You are up and



NOTES:
ALL TURNS STANDARD RATE.
ALL ALTITUDES ARE TERRAIN CLEARANCE.
AVERAGE FUEL CONSUMPTION: 400 POUNDS (INCLUDING PENETRATION).
AVERAGE TIME: 8 MINUTES (INCLUDING PENETRATION).

GG1-108

Figure 6-2. Typical Ground-Controlled Approach

on the glidepath," reduce throttle, drop nose slightly, and establish an initial rate of descent in accordance with the following table. The rates of descent are approximations for a 3-degree glide slope:

Groundspeed	Rate of Descent
150	795
140	745
130	690
120	635
110	585

In general, a 700-fpm rate of descent is most common with a 100-fpm change for 20 knots change in groundspeed. Change rate of descent by 100 fpm for each 1/2 degree variation from a 3-degree glide slope.

WAVEOFF. When instructed, or when at GCA minimums and the field is not in sight, waveoff by adding full throttle, retracting speedbrakes (if applicable) when rotating the nose to a climbing attitude. When a positive climb is indicated by the vertical speed indicator and altimeter, raise the gear and commence a turn if required. Do not raise the flaps until the wings are level and the airspeed is 170 KIAS minimum. When the controller advises "Wave off, tower instruction," this is a mandatory waveoff.

Simulated Instruments

PRACTICE. All simulated instrument flight shall be accompanied by a safety pilot who will maintain a chase position, which is 100 yards on the starboard quarter level with lead aircraft. The safety pilot will not descend below 100 feet and at all times will maintain the same configuration as the lead aircraft. The lead aircraft will not go hooded until cleared by the chase pilot and not before reaching 2000 feet AGL. On GCA, the chase will fly the position assigned by the controller and will not descend below 300 feet AGL. The lead aircraft will go contact at 500 feet AGL. For level turns in the pattern, it will be necessary to add 2 percent rpm; 1 percent rpm change will vary the rate of descent 100 fpm. Radio checks will be exchanged between aircraft at least once every 5 minutes.

Section Penetrations/GCA

Section penetrations and/or GCA's will be necessary when conditions occur which preclude making an individual instrument approach (loss of NAVAID's, radio failure, flight instruments failure, etc.). In section penetrations/GCA's, the wingman flies a comfortable parade formation, close enough to ensure visual contact on the side opposite the missed-approach turn, unless a significant crosswind component exists. In this case, the wingman should be positioned on the upwind side. It will be necessary for the leader to monitor the surface wind and position the wingman accordingly.

leader once the descent on final is started until the leader signals the runway is visible and the wingman has the runway in sight. The leader will execute a low-visibility approach, another GCA, or a section landing as conditions (fuel, weather, etc) require.
weight. The wingman should not descend below the
The wingman will follow the configuration changes of the leader. Appropriate signals for use in the penetration or GCA pattern are contained in Section VII, figure 7-10. After turning onto final, the leader should reduce speed to 140 KIAS for aircraft gross weight of 14,000 pounds or less with an increase of 5 KIAS for each additional 1000 pounds in gross

SECTION LANDINGS

If a section landing is to be made, the leader will not pass the lead and each aircraft will land and roll out in the middle of his half of the runway.

WARNING

To preclude danger of decelerating approach or flying into leader's jet wash, NO ATTEMPT WILL BE MADE TO ESTABLISH LANDING INTERVAL ON FINAL.

CAUTION

If section landings must be made on slick runways or where significant crosswinds exist, extreme caution must be exercised during lineup, touchdown, and rollout.

NOTE

Prior to landing, coordinate use of spoilers between aircraft.

Section penetrations/GCA's may be practiced to a landing; however, prudence dictates that individual landings will normally be made.

LOSS OF VISUAL CONTACT

1. When visual contact with the flight is lost during VFR conditions, proceed to a predetermined point for rendezvous.

2. When visual contact is lost during instrument conditions, the following procedures shall be followed:

a. Notify flight leader by radio.

b. Go on instruments, take 10-degree turn away from leader, hold for 1 minute, then resume original heading. If flying in division "fingertip" formation, number 4 man take 20-degree turn from base course away from section leader, hold for 2 minutes, then resume original heading.

c. If flight conditions permit, wingman should reduce power slightly (1 to 2 percent) to permit additional separation.

d. The flight leader will determine whether the flight should attempt to rendezvous in VFR conditions, or if separation is to be established and maintained through normal ARTC procedures.

Low-Visibility Approaches

A low-visibility approach is used in conditions of low ceiling and/or visibility, when:

1. The approach heading of the aircraft varies from the runway heading to such a degree that it precludes an immediate landing from that direction.

2. The runway is crossed at an airspeed and/or altitude which precludes an immediate landing.

NEW A low visibility approach should be made only when unable to maintain visual contact with the runway.

PROCEDURE

1. When approaching a runway with a landing direction that is approximately 180 degrees from the heading of the aircraft, fly two-thirds of the runway length, then execute a 90-degree SRT turn to the right, followed by a 270-degree SRT reversal to the left to the runway heading. Maintain an airspeed about 10 knots above optimum approach speed/AOA and at or above minimum circling altitude until the runway is again in sight.

2. When approaching the runway in the proper direction, but too high and fast for a landing, maintain an airspeed about 10 knots above optimum AOA/ approach speed and execute a 360-degree left or right SRT. Adjust position by adding a straightaway downwind if necessary. Remain at or above circling minimums until the runway is again in sight.

3. When the aircraft is approximately 90 degrees from the landing runway, cross at not more than one-third of the runway length from the approach end, at 90 degrees from the runway heading. Hold this heading for 20 seconds and then execute a right or left SRT, as appropriate, for the runway heading.

WEATHER CONSIDERATIONS

To conduct flights in accordance with the latest weather information available, pilots on IFR flight plans in the continental United States should make maximum use of "pilot-to-forecaster" services. In addition, radar following can be requested of ARTC on assigned frequency to assist in circumnavigation of storm centers.

Flights which are conducted at high altitudes following climbout through rain or aircraft cold-soaked during a previous flight, will occasionally experience control system icing (aileron or elevator). This is seldom of a serious nature and the controls may be kept free by frequent movement of the control stick fore and aft, or right and left, through neutral. If this is not effective, use trim as necessary and descend below freezing level, if possible.

Ice, Snow, and Rain

Precipitation can create flight hazards when the temperature borders on freezing. A thorough preflight inspection just prior to takeoff is essential. Frost can form on the wing surface in a very short time, making takeoff hazardous. Wet snow, if allowed to accumulate while the aircraft is on the ground, may freeze while the aircraft is gaining altitude and seriously reduce airspeed and range for an indefinite period. Takeoffs should never be attempted when frost, ice, or patches of wet snow adhere to the surfaces.

NOTE

The white and grey color of the aircraft surface may make it difficult to detect glaze ice formation on the wings. Because of the rapidity with which icing conditions may occur, the importance of making last minute checks of the exterior of the aircraft cannot be overstressed.

Taxiing on ice may present problems, particularly in a wind. Icing occurs in flight when freezing conditions exist and one or more of the following weather types are encountered: rain, fog, sleet, wet snow, supersaturated vapor, and high humidity.

NOTE

The aircraft is not equipped to prevent ice formation on the wings or fuselage and should not be flown in areas where heavy icing is likely to be encountered.

Two kinds of icing may be encountered in flight: aircraft icing and engine icing. A loss of airspeed is an indication of both types of icing. Engine icing is recognized by a decrease of engine rpm and an increase in tailpipe temperature. Icing may form in the air intake ducts forward of the engine, and is indicated by an increase in tailpipe temperature and a loss of airspeed, with rpm remaining constant. Icing of the inlet pressure sensing probe of the fuel control may be corrected by switching to MANUAL. Shift at an airspeed of 225 KIAS or above after making sure that throttle position approximately matches existing rpm.

CAUTION

> Operation of the rain removal system to remove snow or ice on the windshield may crack the glass due to extreme thermal shocks and therefore should only be used in an emergency condition.

Snow or fog may occur in the cockpit on certain days when humid air reaches a low (air conditioning) temperature. This usually occurs during takeoffs and landings; within a few seconds visible moisture in front of the pilot may be so thick as to obscure the entire instrument panel. In the event of this phenomenon, the air conditioning control knob should be adjusted to full hot (to be readjusted later to a more comfortable temperature) and the windshield air should be switched from the windshield to the footwarmers by holding the windshield defrost switch in the DECREASE position. Should this fail to correct the situation, the cockpit pressure switch should be moved to RAM. If high humidity exists on takeoff so that cockpit fogging or snow is anticipated, it is recommended that takeoffs be accomplished with the cockpit pressure switch at RAM, moving the switch to NORMAL after the aircraft is comfortably airborne.

In extremely cold weather, some moving parts may freeze. The two most likely to freeze are the slats and the landing gear microswitches. Because of the great force used to actuate the landing gear and gear doors, the gear doors themselves are not likely to freeze open or closed. Prior to takeoff, the pilot should check both slats for freedom of movement. In flight, there is the possibility that one or both slats may freeze closed in freezing rain. After flying in freezing rain, the pilot should check both slats during the approach and, if the slats are frozen in, should approach at an airspeed higher than the recommended approach speed. To get the proper rate of descent and flareout, the pilot must consider buffet onset as a minimum speed factor if the condition of wing slats is not known. Should a landing gear microswitch become frozen, an incorrect gear position indication will be made.

Should canopy frosting occur from ice crystals on the inside, some side vision may be temporarily obtained by scraping off the ice.

On fields which have arresting gear, the arresting hook may be used for landing on wet or icy runways.

There is no water separator in the air conditioning system.

RAIN REMOVAL

The aircraft is equipped with rain removal and rain repellent systems to permit improved visibility upon encountering rain. (Refer to Rain Removal System and Rain Repellent System, Section I, for additional information.)

ANTIFOGGING COMPOUND

An antifogging compound (MIL-A-21070) for coating the interior surface of the windshield and canopy, prevents fogging of these transparent surfaces:

The antifogging compound is applied as follows:

1. Wash interior surface if it is excessively soiled.

2. Apply the antifogging compound, using the application unit.

3. Wipe the surface with a clean, lint-free cloth until it is clear.

CAUTION

- The antifogging compound has a detrimental softening effect on cellulose nitrate instrument lacquer when in contact longer than 1 hour. Care should be taken to prevent contact of the compound with the instrument panel finish.
- The antifogging compound has a severe swelling effect on rubber. Be careful to minimize contact of the compound with the rubber and sealant surrounding the windshield and canopy.

One application of the antifogging compound is effective for a minimum of 10 fogging and drying cycles. When there is doubt as to the condition of the film, a new film should be applied.

Flight in Turbulence and Thunderstorms

Flights through known areas of clear icing or severe turbulence should not be conducted.

TURBULENCE

The key to flying in turbulent air is to "fly attitide." Reduce airspeed to approximately 250 KIAS, fly the all-attitude indicator, and pay less attention to altitude changes.

THUNDERSTORMS

Whenever possible, thunderstorms should be bypassed. If a thunderstorm penetration is unavoidable, the following procedures have been thoroughly tested and proved to be effective.

If a storm area covers a wide front, it is usually advisable to fly above the weather to avoid heavy icing and hail-damage to the plastic nose. However, never attempt to top a storm by sacrificing optimum penetration airspeed. Should operations require some thunderstorm flying, an airspeed of about 250 KIAS will aid in reducing excessive gust loads in the structure. Vertical air currents in well developed thunderstorms will sometimes alter the aircraft altitude several thousand feet, and airspeed will fluctuate considerably. Rather than attempt to fly at a constant altitude, the pilot should maintain the initial flight attitude commensurate with a safe airspeed, keep a constant throttle setting, and use light stick forces to fly the attitude indicator. Abrupt pitch corrections should be avoided. Chasing the airspeed indicator should be avoided because the readings are unreliable during pressure changes within the storm cell and have been known to go to zero during thunderstorm penetration. Flying by pitch attitude reference should keep the airspeed and altitude relatively constant regardless of instrument indications.

BEFORE TAKEOFF

A flight plan avoiding known thunderstorms must be made. A check should be made of all flight instruments, navigation equipment, interior lighting, and the anti-icing system. Pitot heat should not be left "ON," as prolonged ground operation without cooling airflow can damage the heating element.

APPROACHING THE STORM

Preparation before entering the storm may be generalized into four basic steps. The first letter of each step spells HALT: Heat, airspeed/attitude, light, and tight.

Heat

Anti-icing switch in ALL.

Airspeed/Attitude

Reduce airspeed to about 250 KIAS and set throttle friction.

Go on instruments and stabilize airspeed and attitude prior to penetrating the storm.

Adjust all-attitude reference.

Fly on a heading calculated to provide the quickest passage through the storm at an altitude affording the least turbulence and icing while clearing all ground obstacles by a wide margin. Use autopilot, if desired, but do not engage ALT hold.

Light

Turn all cockpit lights on BRIGHT, including white floodlights. (Annunciator panel caution lights will be dimmed.)

Tight

Lower the seat to prevent striking the head against the canopy and to reduce the blinding effect of lightning.

Tighten torso harness straps.

Lock shoulder harness.

IN THE STORM

Once inside the storm, the problem becomes one of holding attitude and heading. Don't chase the altimeter or the airspeed. The primary instrument is the attitude indicator. All control movements should be small and the tendency to "fight" every motion of the aircraft should be avoided. Maintain wings' level and use as little horizontal stabilizer control as possible to minimize the possibility of overstressing the aircraft. The pilot should remember at all times that the aircraft is capable of safely penetrating the storm; however, some damage can be expected from the hail usually encountered. Maintain the initial heading through the storm, correcting any deviation from flight plan after emerging from the weather. Devote all attention to flying the aircraft. Expect turbulence, precipitation, and lightning. Do not allow these conditions to cause undue concern.

OPERATION CONDITIONS

Cold Weather Operations

Low temperatures will be encountered in all regions at high flight altitudes. However, most cold weather difficulties exist on the deck or airfield. Safety of

flight depends on thorough preparation and careful observation of weather by the pilot. Equally important are preflight inspections which lessen the hazards of cold weather when the aircraft is exposed to ice, snow, and frost while on the ground.

NOTE

The collection of ice, snow, and frost on the aircraft surfaces constitutes one of the major flight hazards in low temperature operation and can result in loss of lift and in treacherous stalling characteristics.

BEFORE ENTERING THE AIRCRAFT

A thorough check of the following items should be made by the pilot before entering the cockpit.

1. Visually check engine intakes for evidence of ice.

2. Check fuel drains (defueling valves), fuel lines, and shutoff valves for frozen condensation.

3. Remove all ice from fuel tank vents, static air sources, and pitot tube.

4. Remove dirt and ice from shock struts. Inspect limit switches, door hinges, actuating cylinders, and wheels.

5. Check control surfaces and hinges.

6. Check wing slats for smooth roller and track movement and that they can be closed manually.

7. Check the entire aircraft for freedom from ice, snow, and frost. Carefully remove ice by approved methods and remove snow or frost by light brushing.

CAUTION

- Do not permit ground crew to scrape or chip ice from aircraft surfaces, as damage to the skin will result.
- Check that water from ice removal does not refreeze, particularly on the control hinges.

8. Make sure that wheels are chocked securely to prevent slippage.

ON ENTERING THE AIRCRAFT

The canopy seal must be inspected to make sure that no ice has accumulated to prevent proper seating.

BEFORE STARTING ENGINE

1. Check that compressor rotates freely by momentary starter application. Engine heat on shutdown melts ice accumulated during the previous flight, and the moisture may refreeze on the lower sections of the low-pressure compressor blades. Heat may be applied to melt ice, and engine should be started as quickly as possible after the compressor is free.

2. Before starting, and with external power engaged, the pitot heater should be checked, but should not be left ON, as prolonged ground operation without cooling airflow can damage the heating element.

3. Connect antiexposure suit and check blower operation.

STARTING AND WARMUP GROUND CHECK

1. Use normal procedure for starting engine. If temperature is less than -35°C, run at IDLE for 2 minutes before takeoff.

2. Make sure all instruments have been sufficiently warmed up to ensure normal operation. Check for sluggish instrument indicator movement during taxiing.

3. Check all flight controls, both visually and by feel, for unrestricted movement.

4. Run through a complete cycle with rudder trim, stabilizer trim, aileron trim (observing the tab), stick, speedbrakes, and flaps, several times, to ensure correct operation.

5. Cabin temperature knob as desired.

6. Be cautious while running engine up on a slippery surface, as the chocks may slide. A normal full power check can be made during the initial part of the takeoff roll.

TAXIING

1. Maintain directional control using nosewheel steering (A-4F) and brakes (A-4E) as required.

2. If it is necessary to taxi on ice or snow, allow greater distance for braking action. Skidding may occur with temporary loss of control when sharp turns are made or when a crosswind exists. Taxiing in deep snow is difficult and may also cause freezing of brakes and gear after takeoff.

3. Avoid taxiing through melted snow or slush caused by the jet blast of other aircraft, to prevent accumulation of ice on the aircraft surfaces.

4. Be careful when taxiing in the vicinity of other aircraft. Increase the space between aircraft to ensure safe stopping distance. Jet blast can impair visibility by blowing clouds of dry snow over a large area.

5. Minimize taxi time to conserve fuel and reduce amount of ice-fog generated by jet engines.

BEFORE TAKEOFF

1. Turn air conditioning temperature to hot temporarily, to ensure minimum fogging and frosting.

WARNING

Do not take off with frosted windshield, or with frost, snow, or ice on wings or control surfaces.

2. Pitot heat ON just prior to takeoff.

3. If surface of runway is too slippery for engine runup, the power check must be made during early part of takeoff.

TAKEOFF

1. When starting the takeoff run, advance the throttle rapidly and check engine instruments.

2. After takeoff from snow or slush-covered runways, operate the landing gear and wing flaps through several cycles to prevent possible freezing in the up position. (Expect considerably slower operation of the landing gear in cold weather.)

CAUTION

- Do not exceed the wheels and flaps down airspeed limits during the cycling operation.
- Do not apply brakes to stop rotation of retracted wheels.

3. Check instruments. At extremely low outside air temperatures, instruments should be sufficiently warmed up to ensure reliable operation.

DURING FLIGHT

1. The flight characteristics of the aircraft are not affected by cold weather, although colder than normal temperature increases air density and produces greater ram pressure. Engine rpm, therefore, may be reduced to establish the desired airspeed-altitude combination for maximum range.

2. Use cockpit air conditioning system as desired.

DESCENT

1. Should canopy frosting or fog or snow in the cockpit occur, increase the temperature. The heated windshield (nesa glass) should give forward vision and, in an emergency, some side vision can be obtained by scraping off the ice with a glove. (Use a kneeboard or sharp object only in an extreme emergency.)

2. If flight has been through freezing rain, check that slats open in the landing approach. (Refer to Ice, Snow, and Rain.)

3. A carrier-type approach is recommended for landing on wet and icy runways to lessen the possibility of skidding. This approach gives the maximum runway available, requires a minimum of braking, and allows landing at the lowest airspeed.

LANDING

When landing on snow, or wet or ice-covered runways, be careful to avoid drift which will cause skidding and consequent loss of control. Maintain a straight course down the runway, applying brakes evenly and lightly. The best approach to a landing on wet and icy runways is a carrier-type approach, with touchdown as close to the end of the runway as possible. After touchdown, retract flaps and leave speedbrakes extended for drag and increased braking effectiveness. The proper braking technique is light tapping of the pedals. If the aircraft starts to skid, the brakes should be released and tapping should be resumed after the aircraft again tracks normally. In A-4F aircraft, nosewheel steering may be used below 60 knots to maintain directional control.

NOTE

Hard braking on icy or wet runways may result in dangerous skidding or fishtailing.

Be certain to turn the pitot heater and engine anti-icing switch OFF after landing.

SHUTDOWN AND POSTFLIGHT

1. Use normal shutdown procedures.

2. See that wheels are chocked securely.

3. Have aircraft serviced and fuel lines (defueling valves) drained. Every effort should be made during servicing to prevent moisture from entering the fuel system.

4. Have covers and plugs installed in mooring outside. Make certain aircraft is tied down securely.

5. If it is not snowing or raining, leave canopy open to allow circulation until the cockpit has cooled off, to prevent canopy cracking from differential contraction.

Hot Weather and Desert Operation

When wearing tight clothing, take as little time as possible in getting the engine started if ground connected air conditioning is not provided for the cockpit. Metal exposed to the sun can inflict severe burns.

BEFORE STARTING ENGINE

1. Make visual inspection of the aircraft exterior, checking for system leakages, sand or dust accumulation, tire overinflation or blistering, corrosions, and loose inspection plates.

2. Check that all lockpins, protective covers, and plugs (including pitot head cover) are removed.

3. Make any other necessary ground checks prior to starting engine, such as oxygen and fuel servicing.

4. Make sure air conditioning system is turned on.

AFTER STARTING ENGINE

1. Make engine ground runup as short as possible.

2. Acceleration to IDLE rpm will take longer than on a normal or cold day.

TAXIING AND TAKEOFF

1. Avoid excessive use of brakes.

CAUTION

When aggravated by hot weather, excessive use of brakes is likely to increase tire pressure and decrease both tire and wheel strength sufficiently to cause explosive failure. Such a failure, if it occurs after a wheel is retracted, can rupture a door fairing, or integral fuel tank.

2. Watch exhaust temperatures closely.

3. Because of the lower density of air in hot weather, be prepared for slower acceleration, longer takeoff distance, and reduced thrust at all throttle settings. The increased requirement for takeoff distances commonly associated with hot weather operation of any aircraft is even greater for jet. An increase in temperature of $1^{o}C$ will result in a 1 percent increase in takeoff distance. TAS will be greater for the normal IAS, and strict adherence to recommended IAS is essential to safe flight.

CAUTION

Do not attempt to take off in a sandstorm or duststorm. Park the aircraft crosswind and shut down the engine to prevent sand or dirt from damaging the engine.

BEFORE LEAVING AIRCRAFT

1. If sand or dust is not blowing, leave canopy open to permit air circulation within the cockpit.

2. Check that protective covers are installed on pitot head, canopy, and intake and exhaust ducts.

SECTION VII
COMMUNICATIONS PROCEDURES

TABLE OF CONTENTS

COMMUNICATIONS

General

Because of the nature of jet operations, voice radio is normally used for communications between aircraft. Occasionally, however, conditions of radio silence are prescribed for certain operations. Proficiency in the use of visual signals must therefore be maintained by all pilots.

Information and additional references concerning the following categories of radio/electronic communications are contained in Chapter VI of NWP 41 (series):

1. Communications procedures and terminology
2. Operational use of voice radio
3. Standard fleet weather reporting procedures
4. Contact reports
5. Aircraft identification procedures
6. IFF procedures.

Radio Communication

RADIO DISCIPLINE

Good operating procedures must be practiced by each pilot if radio communication is to be effective. Compliance with the basic, common sense guidelines of correct radio operation which follows will eliminate the most frequent breaches of good radio discipline:

1. Use proper R/T voice procedure and terminology.
2. Do not cut in on other transmissions.
3. Make only necessary transmissions and then be as brief as possible.
4. Use complete call signs to avoid confusion.
5. Mentally phrase a message prior to keying the mike.
6. Delay the transmission approximately 1 second after keying the mike to avoid loss of the first syllable.
7. Transmit on the guard channel only in an emergency.
8. Leave the UHF selector switch on T/R & G position.
9. Take pride in a "silent" flight, if it can be accomplished safely and effectively.
10. Do not switch the radio or IFF frequency codes below 2500 feet at night or instrument conditions except for urgent military necessity. If this necessity arises, the aircraft should be in stabilized, level flight before changing frequencies or codes.

Visual Communications

Aircraft visual communications include those made with the hands or other parts of the body, aircraft maneuver, code transmission, or lights. Ground-to-air signals also include panel signals or other displays.

Information and additional references concerning the following categories of visual communications are contained in Chapter VI of NWP 41 (series):

1. Air-station control-tower light signals.

2. Signals between ground and aircraft for use by downed pilots. These include body signals, international ground-air emergency codes and aircraft replies, paulin signals, pyrotechnics, ground search-party signals, RESCAP rescue, and miscellaneous signals.

Visual signals should be used between aircraft whenever practicable, provided no loss in operational efficiency results. Those signals with which the pilot is primarily concerned are contained in this manual, as follows:

1. Starting and poststart signals (figure 7-2).

2. No-radio-penetration/instrument approach signals (figure 7-10).

3. Flight signals between aircraft:

Night Tactical Signals

Night tactical signals are usually given on voice radio, but they may be transmitted by the use of external lights or by a maneuver using the appropriate signal as shown. Maneuvers at night should be kept to a minimum consistent with the effective performance or the assigned task.

Signals Between Aircraft and Surface Ships

If an aircraft which is not in radio communication with a ship wishes to attract attention to survivors or to an aircraft in distress, a standard procedure is used. The aircraft first circles the ship closely at low altitude. This circle is made at least once. The pilot then flies across the bow of the ship at low altitude with the hook up, changing power setting and rocking the wings. After this, he heads in the direction of the distress incident. Flight across the bow and in the direction of the incident is repeated until the ship acknowledges by following the aircraft.

The ship should either follow the aircraft or indicate by the visual signal "NOVEMBER" that this is impossible. The action taken must be reported to the OTC. Surface ships may use signals from the one-letter code given below when assisting a distressed aircraft.

Surface Ship One-Letter Code

A one-letter aircraft code is available to surface ships for controlling the aircraft. The code is peculiar to aircraft operations and is limited to that use. The signals are made only by flashing-light or deck panels. Letters and their meanings are as follows:

Code	Meaning
B	Make passes.
C	Land aboard.
D	Delay; reform; remain within signal distance until further notice. (When the delay in recovery will be for more than 5 minutes, the number of minutes, in tens, may be flashed after the letter "D." Example: a 20-minute delay would be indicated by flashing the signal "D2.".)
F	Flaps are not down.
G	Jettison droppable fuel tank(s).
H	Hook is not down.

Code	Meaning
K	Your (my) aircraft is damaged. (Unless otherwise directed, aircraft should land aboard carrier last.)
M	Proceed to base or carrier in accordance with doctrine or orders. (Unless otherwise briefed, this signal will mean to proceed to the designated bingo field, or if not designated, to the nearest suitable field.)
Q	Jettison bombs.
R	Radio failure. (By aircraft, utilizing the external lights or white fuselage lights.)
S	Flight Commander fly alongside and read signals.
U	Turn off (on) running lights.
W	Lower landing gear.
X	Previous landing order canceled.
Z	Do not land aboard; ditch aircraft in water or eject.

Signal		Meaning	Response
Day	Night		
1. Thumbs-up, or nod of head.	Flashlight moved vertically up-and-down repeatedly.	Affirmative. ("Yes," or "I understand.")	
2. Thumbs-down, or turn of head from side to side.	Flashlight moved horizontally back-and-forth repeatedly.	Negative. ("No," or "I do not understand.")	
3. Hand cupped behind ear as if listening.		Question. Used in conjunction with another signal, this gesture indicates that the signal is interrogatory.	As appropriate.
4. Hand held up, with palm outward.		Wait.	
5. Hand waved back and forth in an erasing motion in front of face, with palm turned forward.	Letter N in code, given with external lights.	Ignore my last signal.	
6. Hand held up, with thumb and forefinger forming an 0 and remaining fingers extended.		Perfect, well done.	
7. Employ fingers held vertically to indicate desired numerals 1 through 5. With fingers horizontal indicate number which added to 5 gives desired number from 6 to 9. A clenched fist indicates 0. (Hold hand near canopy when signalling.)		Numerals as indicated.	A nod of the head ("I understand"). To verify numerals, addressee repeats. If originator nods, interpretation is correct. If originator repeats numerals, addressee should continue to verify them until they are understood.
8. Make hand into cup-shape, then make repeated pouring motions.		I am going to dump fuel.	
9. Slashing motion of index finger across throat.		I have stopped dumping fuel.	
10. Horizontal "∞" sign	Same with wands.	You are on fire.	As required.

Figure 7-1. General Signals

Signal		Meaning	Response	
Day	Night	Day and Night	Day	Night
1. Pilot holds one finger vertically.	Same	Start GTC.	P/C executes.	Same NOTE 1
2. Plane captain holds two fingers vertically, then points to: Pilot (for pilot-controlled start) or Self (for ground-controlled start). NOTE 2	Same	GTC is up to speed and READY light is lit. GTC hose connected. Electrical power for ignition available. 1. This will be a pilot-controlled start. 2. This will be a ground-controlled start.	None	Same
3. Pilot holds two fingers vertically.	Same	1. If pilot-controlled start, START-ABORT switch is depressed. 2. If ground-controlled start, P/C open GTC air valve.	P/C returns rotating two-finger signal when GTC hose inflates.	P/C rotates flashlight vertically when GTC hose inflates.
4. Pilot holds three fingers vertically.	Same	1. Pilot-controlled start: START-ABORT switch has popped up. P/C remove starting air hose and electrical service cable. 2. Ground-controlled start: Engine RPM is at 50 percent. P/C close GTC air valve and remove starting air hose and electrical cable.	1. P/C checks for GTC hose collapse, removes starting air hose and electrical cable, and secures access panel. 2. P/C closes GTC air valve, checks for hose collapse, removes starting air hose and electrical cable, and secures access panels.	Same
5. If necessary, P/C attract pilot's attention by waving arms over head. Give "cut" signal by slashing motion of index finger across throat.	If necessary, P/C attract pilot's attention with flashlight. Give "cut" signal by repeated slashing of flashlight across throat.	Secure start/cut engine.	Pilot move throttle to OFF.	Same
6. P/C gives "OK" signal by forming circle with thumb and forefinger, with remaining fingers extended.	Same	Hydraulic pressure is 3000 psi on wheel well gages.	Pilot acknowledges with "thumbs-up."	Pilot moves horizontally-held flashlight up and down several times.

Figure 7-2. Starting and Poststart Signals (Sheet 1)

Signal		Meaning	Response	
Day	Night	Day and Night	Day	Night
7. P/C holds vertical fist in front, makes large horizontal circle with fist. NOTE 2	Same, except with vertically held flashlight pointed upward. NOTE 2	Pilot move all controls through full travel, checking for proper throw and feel, no hydraulic ladder lights ON when flight controls are moved rapidly. Then position flight controls as follows: full left rudder, stick full aft and port.	Pilot execute. P/C check control surfaces for correct deflection.	Same
8. P/C holds hands in front of body with palms together horizontally and makes: Open, or Closing motion with palms in alligator-mouth fashion. NOTES 2, 3, & 7	Same NOTES 2, 3, & 7	1. Lower flaps. 2. Raise flaps	Pilot execute. P/C check both flaps for: 1. Full deflection and security (certain ordnance configurations may restrict flaps to less than full deflection). 2. Full retraction and security. If satisfactory, give pilot "thumbs-up" after check is complete.	Same
9. P/C gives previous signal, followed immediately by "plus" sign formed by index fingers. NOTES 2 & 3	Same NOTES 2 & 3	Pilot raise or lower flaps to 1/2 deflection as signalled.	Pilot execute. P/C check both flaps for 1/2 deflection and security. If satisfactory, give pilot "thumbs-up" after check is complete.	Same
10. P/C holds hand in front, palm vertical, and makes: Open, or Closing motion with palms in alligator-mouth fashion. NOTES 2 & 3	Same NOTES 2 & 3	1. Extend speedbrakes. 2. Retract speedbrakes.	Pilot execute. P/C check both speedbrakes for: 1. Full extension, leaks, security. 2. Full retraction. If satisfactory, give pilot "thumbs-up" after check is completed.	Same
11. P/C holds hand in front and Suddenly lowers other fist, with thumb extended downward to meet horizontal palm of extended hand.	Same, except points flashlight vice thumb toward extended palm of hand in direction desired.	1. Lower arresting hook.	Pilot execute. P/C check: 1. Hook down and for effective snubber action.	Same

Figure 7-2. Starting and Poststart Signals (Sheet 2)

Signal		Meaning	Response	
Day	Night	Day and Night	Day	Night
11. (Continued) Suddenly raises other fist, with thumb extended upward to meet horizontal palm of extended hand. NOTES 2 & 3	NOTES 2 & 3	2. Raise arresting hook.	2. Hook retracted and centered. If satisfactory, give pilot "thumbs-up" after check is completed.	
12. P/C holds one finger aloft. NOTE 4	Same. Illuminated by flashlight. NOTE 4	Cycle and set rudder trim to 0 degrees, using trim indicator.	Pilot execute. P/C points index finger toward vertical palm of other hand in direction rudder must be moved if not faired by pilot. When faired, P/C give next sequential signal. Pilot check indicator for possible error and note.	Pilot: Same. P/C: same, except use flashlight vice finger to indicate direction rudder must be moved.
13. P/C holds two fingers aloft. NOTE 4	Same. Illuminated by flashlight. NOTE 4	Cycle, override in both directions, and set elevator trim to 8 degrees noseup, using trim indicator. (If setting other than 8 degrees noseup trim is desired, the pilot shall inform P/C of desired setting prior to start.)	Pilot execute. P/C indicates trim setting by numerical hand signal. Pilot checks indicator for possible error, notes same, and corrects trim setting if error exists.	Pilot: Same. P/C: same, except use flashlight vice finger to indicate direction elevator must be moved.
14. P/C holds three fingers aloft. NOTE 4	Same. Illuminated by flashlight. NOTES 4 & 5	Cycle aileron trim and follow P/C signals. Check stick centered and aileron followup tab ±1/5 inch from aileron.	Pilot execute. P/C signal cycling of aileron trim and set ailerons symmetrically (both equally up, down, or even) and tab at ±1/5 inch.	Same
15. P/C holds four fingers aloft.	Same. Illuminated by flashlight.	Pressurize external drop tanks and/or buddy store. P/C check pressurization.	Pilot execute.	Same
P/C holds five fingers aloft.	Same. Illuminated by flashlight.	Depressurize external drop tanks and/or buddy store.	Pilot execute.	Same
16. Pilot points one finger at eye.	Same NOTE 6	P/C check all exterior lights BRIGHT, then DIM. (Modify locally, as necessary, according to situation.)	P/C execute. Give pilot "thumbs-up" after checking lights BRT, then check on DIM.	Same

Figure 7-2. Starting and Poststart Signals (Sheet 3)

Signal		Meaning	Response	
Day	Night	Day and Night	Day	Night
17. P/C holds nose, then gives "thumbs-up or down."	Same	Aircraft has no visible fuel, oil, or hydraulic leaks. Fuel has ceased draining from gang drain. (During start, indicates wet start.)	Pilot acknowledge with "thumbs-up."	Same
18. Pilot holds closed fist with thumb extended horizontal.	Same except flashlight vice thumb held horiz.	P/C cycle approach light hook bypass switch in nosewheel well.	P/C executes.	Same
19. P/C forms circle with thumb and forefinger, then extracts forefinger of opposite hand from circle, using "pull-away" motion.	Same, except makes "pull-away" motion with flashlight.	Can I remove landing gear and external store-racks safety pins?	Pilot give "thumbs-up" (YES) or "thumbs-down" (NO). If yes, P/C removes pins and holds for pilot to count before stowing in pin bag in left-hand wheel well or aft hell-hole.	Same, except pilot moves horizontally-held flashlight up and down several times (YES) vice "thumbs-up" signal, or left and right several times (NO) vice "thumbs-down" signal.
20. P/C pats back of neck with hand.	Same. Use flashlight vice hand.	Check ejection control safety handle in desired position.	Pilot check handle.	Same
21. P/C gives one finger turnup when cleared by flight deck director.	Same. Illuminated by wand.	You are cleared for turnup for fuel control check.	Pilot executes fuel control check.	Same
22. P/C extends arms bent 90 degrees so hands are level in front of chest. Place right palm on top of left hand and with positive movement raise right hand and lower left hand.	Same, except make signal with wands.	Can I move EXT/INT switch to EXT position?	Pilot gives "thumbs-up" (YES) or "thumbs-down" (NO).	Same, except pilot moves horizontally-held flashlight up and down several times (YES) vice "thumbs-up" signal, or left and right several times (NO) vice "thumbs-down" signal.
23. Plane director puts forefinger on end of nose then gives a "thumbs-up."	Same. Use wands vice fingers.	Tillerbar connected. Director will assume directional control.	Head nod. Pilot controls only speed of aircraft with brakes.	Same
Plane director puts forefinger on end of nose then makes a downward sweeping motion with forearm toward direction of aircraft movement.	Same. Use wands vice fingers.	Tillerbar disconnected. Pilot will assume directional control.	Head nod. Pilot assumes directional control.	Same
24. P/C extends arms directly in front of himself placing right palm on top of left palm, and with positive movement, raises right hand directly overhead.	Same, except make signal with wands.	Activate spoilers open.	Turn spoiler switch to ARM. Advance and quickly retard throttle. Spoilers should close and reopen.	Same

Figure 7-2. Starting and Poststart Signals (Sheet 4)

Signal		Meaning	Response	
Day	Night	Day and Night	Day	Night
24. (Continued) P/C lowers arm to original extended position.	Same, except make signal with wands.	Activate spoilers closed.	Pilot turns spoiler switch OFF. When spoilers close, P/C gives "thumbs-up" to pilot.	Same

NOTES:

1. Where night signal is listed as "Same," unless otherwise indicated, signal is identical to day signal, except red flashlight is used to illuminate hand (if appropriate).
2. Prior to giving this signal, the affected area must be checked visually by the P/C to ensure that there exists no hazard to personnel.
3. Normally, these hand signals will be given in close sequence without hesitation; i.e., flaps, speedbrakes, hook. The pilot shall hold up both hands to prevent actuation of hydraulically operated systems while the plane captain checks the speedbrakes, flaps, spoilers, and hook.
4. P/C shall be stationed at port wingtip, within sight of pilot, for the trim signals.
5. After giving 3-finger signal, P/C illuminates followup tab from inboard end.
6. For use prior to night flight or at pilot's discretion.
7. During periods of operations in which ordnance configurations limit flaps to less than full extension, this check may be conducted using half flaps vice full flaps.

Figure 7-2. Starting and Poststart Signals (Sheet 5)

Signal		Meaning	Response
Day	Night		
1. Section takeoff-leader raises either forearm to vertical position. 2. Wingman raises forearm. 3. Leader lowers arm.	Refer to Night Flying, Section III, for night section takeoff light signals.	1. I have completed my takeoff checklist and am ready for takeoff. 2. I have completed my takeoff checklist and am ready for takeoff. 3. Takeoff path is clear, I am commencing takeoff.	1. Stands by for reply from wingman, holding arm up until answered. 2. Wingman lowers arm and stands by for immediate takeoff. 3. Execute section takeoff.
Leader pats self on the head, points to wingman.	1. Lead aircraft switches lights to BRT/STDY. 2. If external lights are inoperative, leader shines flashlight on hardhat then shines light on wingman.	Leader shifting lead to wingman.	1. Wingman pats head and assumes lead. 2. Wingman places lights on DIM/STDY and assumes lead. 3. Wingman shines flashlight at leader, then on his hardhat and assumes lead.
Leader pats self on head and holds up two or more fingers.		Leader shifting lead to division designated by numerals.	Wingman relay signal; division leader designated assumes lead.

Figure 7-3. Takeoff, Changing Lead, Leaving Formation, Breakup, and Landing (Sheet 1)

Signal		Meaning	Response
Day	Night		
Pilot blows kiss to leader.		I am leaving formation.	Leader nods ("I understand") or waves goodby.
Leader blows kiss and points to aircraft.		Aircraft pointed out leave formation.	Wingman indicated blows kiss and executes.
Leader points to wingman, then points to eye, then to vessel or object.		Directs plane to investigate object or vessel.	Wingman indicated blows kiss and executes.
Division leader holds up and rotates two fingers in horizontal circle, preparatory to breaking off.		Section break off.	Wingman relays signal to section leader. Section leader nods ("I understand") or waves goodby and executes.
Leader holds hand over head and makes a circular motion with forefinger extended.	Series of "I's" in code, given by external lights.	Breakup (and rendezvous).	Wingman take lead, pass signal after leader breaks, and follow.
Landing motion with open hand:		Refers to landing of aircraft, generally used in conjunction with another signal.	
1. Followed by patting head.		1. I am landing.	1. Nods. ("I understand") or waves goodby.
2. Followed by pointing to another aircraft.		2. Directs indicated aircraft to land.	2. Aircraft indicated repeats signal, blows a kiss and executes.

Figure 7-3. Takeoff, Changing Lead, Leaving Formation, Breakup, and Landing (Sheet 2)

Signal		Meaning	Response
Day	Night		
Open hand held vertically and moved forward or backward, palm in direction of movement.		Adjust wing position forward or aft.	Wingman moves in direction indicated.
Open hand held horizontally and moved slowly up or down, palm in direction of movement.		Adjust wing position up or down.	Wingman moves up or down as indicated.
Open hand used as if beckoning inboard or pushing outboard.		Adjust wing position laterally toward or away from leader.	Wingman moves in direction indicated.
Hand opened flat and palm down, simulating dive or climb.		I am going to dive or climb.	Prepare to execute.

Figure 7-4. Formation Signals (Sheet 1)

Signal		Meaning	Response
Day	Night		
Hand moved horizontally above glareshield, palm down.		Leveling off.	Prepare to execute.
Head moved backward		Slow down.	Execute.
Head moved forward.		Speed up.	Execute.
Head nodded right or left.		I am turning right or left.	Prepare to execute.
Thumb waved backward over shoulder.	Series of 00's in code, given by external lights.	Take cruising formation or open up.	Execute.
1. Holds up right (or left) forearm vertically, with clenched fist or single wing-dip. 2. Same as above, except with pumping motion or double wing-dip.	1. Single letter R (or K) in code, given by external lights. 2. Series of RR's (or KK's) in code, given by external lights.	1. Wingman cross under to right (or left) echelon or in direction of wing-dip. 2. Section cross under to right (or left) echelon or in direction of wing-dips.	1. Execute. 2. Execute.
Triple wing-dip.		Division cross under.	Execute.
	Series of VV's in code, given by external lights.	Form a Vee or balanced formation.	Execute.
Series of zooms.	Series of XX's in code, given by external lights.	Close up or join up; join up on me.	Execute.
Rocking of wings by leader.		Prepare to attack.	Execute preparation to attack.
Rocking of wings by any other member of flight.		We are being, or are about to be, attacked.	Standby for and execute defensive maneuvers.
Lead plane swishes tail.		All aircraft in this formation form stepdown column in tactical order behind column leader.	Execute. Leader speeds up slightly to facilitate formation of column.
Shaking of ailerons.	Long dash, given with external lights.	Execute signal; used as required in conjunction with another signal.	Execute last signal given.

Figure 7-4. Formation Signals (Sheet 2)

Signal		Meaning	Response
Day	Night		
Tap earphones, followed by patting of head, and point to other plane.		Take over communications.	Repeat signals, pointing to self, and assume communications lead.
Tap earphones, followed by patting of head.		I have taken over communications.	Nod ("I understand").
Tap earphones and indicate by finger-numbers, number of channels to which shifting.		Shift to radio frequency indicated by finger-numbers.	Repeat signal and execute.
Tap earphones, extend forearm vertically, and rotate fingers, formed as if holding a grapefruit followed by four numbers.		Manually set up ARC-51A on frequency indicated.	Repeat signal and execute.
Tap earphones, followed by question signal.		What channel (or frequency) are you on?	Indicate channel (or frequency) by finger-numbers.
Tap earphones and point to plane being called, followed by finger-numbers indicating frequency.		You are being called by radio on channel indicated by finger-numbers.	Repeat numbers. Check receiving frequency and switch to channel indicated by originator. Dial in manually, if necessary.
Vertical hand, with fingers pointed ahead and moved in a horizontal sweeping motion, with four fingers extended and separated.		What is bearing and distance to the TACAN station?	Wait signal, or give magnetic bearing and distance with finger-numbers. The first three numerals indicate magnetic bearing and the last two or three, distance.
Vertical hand, with four fingers extended and separated, pointed ahead in a fore-and-aft chopping motion, followed by a question signal.		What is bearing to TACAN station?	Repeat signal and give bearing in three digits.
Arm and vertical hand, with four fingers extended and separated, moved ahead in a fore-and-aft circular motion, followed by question signal.		What is distance to TACAN station?	Repeat signal and give distance in two or three digits.
TACAN bearing or distance signal, followed by thumbs up or down.		TACAN bearing or distance, up or down.	Thumbs up or nod ("I understand").
TACAN bearing signal, followed by finger-numbers.		Switch to TACAN station indicated.	Repeat and execute.

Figure 7-5. Electronic Communications and Navigation (Sheet 1)

Signal		Meaning	Response
Day	Night		
Hand held up. First and fourth fingers extended, moved in fore-and-aft chopping motion, followed by:			
1. Four numbers.		1. Set up UHF/ADF on frequency indicated.	1. Repeat signal and execute.
2. Question signal.		2. What is UHF/ADF bearing?	2. Repeat chopping motion, followed by wait, or three numerals indicating magnetic bearing.
3. Up or down signal.		3. My UHF/ADF is up or down.	3. Thumbs up or nod ("I understand").
Two fingers pointed toward eyes (meaning IFF signals), followed by:			Repeat, then execute.
1. "CUT".		1. Turn IFF to "STANDBY".	
2. Three-digit numbers.		2. Set mode and code indicated; first numeral-mode, second and third numerals - code.	
1. Open hand held up, fingers together, moved in fore-and-aft chopping motion (by leader).		1. Course to be steered is present compass heading.	1. Nod of head ("I understand").
2. Followed by question signal.		2. What is your compass heading?	2. Repeat signal and give compass heading in finger-numbers.
3. Followed by three finger-numbers.		3. My compass heading is as indicated by finger-numbers.	3. Nod or clarify, as appropriate.
Tap oxygen mask (or earphones) and give thumbs down.	Turn wing and taillights BRT/FLASH.	I have UHF transmitter (or receiver) failure.	Execute no radio procedure as briefed. Attempt contact on guard if necessary.

Figure 7-5. Electronic Communications and Navigation (Sheet 2)

Signal		Meaning	Response
Day	Night		
1. Pistol-cocking motion with either hand. 2. Followed by question-signal. 3. Followed by thumbs-down signal.		1. Ready or safety guns, as applicable. 2. How much ammo do you have? 3. I am unable to fire.	1. Repeat signal and execute. 2. Thumbs-up – "over half"; thumbs-down – "less than half." 3. Nod head ("I understand").
1. Shaking fist. 2. Followed by question-signal. 3. Followed by thumbs-down signal.		1. Arm or safety bombs, as applicable. 2. How many bombs do I have? 3. I am unable to drop.	1. Repeat signal and execute. 2. Indicate with appropriate finger-numbers. 3. Nod head ("I understand").
1. Shaking hand, with fingers extended downward. 2. Followed by question-signal. 3. Followed by thumbs-down signal.		1. Arm or safety rockets, as applicable. 2. How many rockets do I have? 3. I am unable to fire.	1. Repeat signal and execute. 2. Indicate with appropriate finger-numbers. 3. Nod head ("I understand").
Pistol cocking motion with either hand, followed by fore and aft pulling motion with a clenched fist.	1. Rotating beacon ON and OFF by lead aircraft. 2. Rotating beacon turned ON for second time (allow time for setting up switches).	Jettison external stores. 1. Set up your switches for jettison. 2. You are cleared to drop.	Repeat signal and execute. 1. Set up jettison/ordnance switches. 2. Execute.
Fingers to be extended horizontally: 1. One finger. 2. Two fingers. 3. Three fingers. 4. Four fingers. 5. Five fingers.	Same signals with fingers held in front of flashlight.	1. JATO arming switch ARMED. 2. Depress JATO firing button. 3. Release JATO firing button. 4. JATO arming switch OFF. 5. JATO connected and ready.	1. Repeat signal and execute. 2. Repeat signal and execute. 3. Repeat signal and execute. 4. Repeat signal and execute. 5. JATO arming switch ARMED. Check JATO armed indicator light ON. If no light, give four-finger signal to ordnance crew to recheck. If no light after recheck, return to line.

Figure 7-6. Armament

Signal		Meaning	Response
Day	Night		
Raise fist with thumb extended in drinking position.		How much fuel have you?	Repeat signal, then indicate fuel in hundreds of pounds by finger-numbers.
Rotary movement of clenched fist in cockpit as if cranking wheels, followed by head nod.	Letter W in code, given by external lights, or rotary motion of flashlight.	Lower or raise landing gear and flaps, as appropriate.	Repeat signal. Execute when leader changes configuration.
Leader lowers hook.	Letter H in code, given by external lights.	Lower arresting hook.	Wingman lower arresting hook. Leader indicate wingman's hook is down with thumbs-up signal.
Open and close four fingers and thumb.		Extend or retract speed-brakes, as appropriate.	Repeat signal. Execute upon head nod from leader or when leader's speed-brakes extend/retract.

Figure 7-7. Aircraft and Engine Operation

Signal		Meaning	Response
Day	Night		
One finger turnup signal.		By receiver: start turbine.	Tanker execute. Receiver gives thumbs-up when turbine starts.
Form cone-shape with hand, all fingers extended aft (make signal close to canopy). 1. Cone moved aft. 2. Cone moved forward.		1. By receiver: extend drogue. 2. By receiver: retract drogue.	Tanker execute. Receiver give thumbs-up if: 1. Drogue extends properly. 2. Drogue retracts fully and air turbine feathers.
Make hand into cup-shape, then make repeated pouring motions.		By tanker: I am going to dump fuel.	By receiver: Nod. Give thumbs-up when fuel dumping commences.
Slashing motion of index finger across throat.		By tanker: I have stopped dumping fuel.	By receiver: Give thumbs-up if fuel dumping has ceased.

Figure 7-8. Air Refueling

Signal: Day	Signal: Night	Meaning	Response
Arm bent across forehead as if weeping: 1. Followed by HEFOE signal and code. 2. Followed by landing signal.	Series of dots with external lights followed by: 1. HEFOE signal and code. 2. HEFOE signal and code, followed by wheels signal.	I am in trouble. 1. I am having trouble with indicated system. 2. I must land immediately.	Escort disabled plane, assuming lead, if indicated, and return to base or nearest suitable field.
MALFUNCTIONING OF EQUIPMENT (HEFOE CODE)			
Arm bent across forehead as if weeping and then indicating by finger-numbers 1 to 5 the affected system.	Flashlight held close to top of canopy, pointed toward wingman, followed by 1 to 5 dashes to indicate system affected.	Number of fingers or dashes means: 1. Hydraulic system. 2. Electric system (including TACAN and flight instruments). 3. Fuel system. 4. Oxygen system. 5. Engine.	Day: Nod, or thumbs-up ("I understand"). Night: Vertical movement of flashlight. Pass lead to disabled plane or assume lead, if indicated.

Figure 7-9. Emergency Signals Between Aircraft

Signal: Day	Signal: Night	Meaning	Response
Open and close four fingers and thumb in pinching motion.	3 dashes w/external lights.	Extend speedbrakes, commencing approach.	Execute when leader extends speedbrakes.
Rotary movement of clenched fist in cockpit as if cranking wheels.	2 dashes w/external lights.	Extend wheels and full flaps.	Execute when leader extends wheels, flaps.
Pointing index finger toward runway/ship in stabbing motion, repeatedly, followed by lead change signal.	Series of dashes w/external lights.	Landing runway/meatball and ship in sight.	Ashore: Take position for landing. Carrier: Break off and land.

Note: Configuration change should be executed promptly after completion of the signal.

Figure 7-10. Flight Signals Between Aircraft Penetration/Instrument Approach (no radio)

Signal		Meaning	Response
Day	Night		
ARMING			
1. Arming supervisor: Hands over head with fingers touching.	Red wands over the head with tips touching.	Pilot: Check all armament switches OFF or SAFE.	Pilot: Execute. Raise both hands into view of arming supervisor after checking switch positions. (Hands remain in view during check and hook-up).
2. Arming supervisor: Points at crewmember (used if applicable).	Same as day only with red wand.	Crew: Perform stray voltage checks.	Arming crew: Execute. Give arming supervisor thumbs-up if no stray voltage exists. Thumbs down if exists. Night: Vertical sweep with flashlight indicates no stray voltage. Horizontal sweep indicates stray voltage.
3. Arming supervisor: Raises fist, thumb extended upward, to meet horizontal palm of other hand.	Form a Tee with red wands.	Arming Crew: Arm weapons (as applicable).	Arming crew: Execute. Give arming supervisor thumbs-up when arming completed and clear, immediate area. Thumbs down if a malfunction exists. Night: Same as step 2 above.
4. Arming supervisor gives pilot:			Pilot:
a. Thumbs-up.	a. Vertical sweep with red wand.	a. Aircraft is armed and all personnel and equipment clear of area.	a. Acknowledge with similar signal.
b. Thumbs-down.	b. Horizontal sweep with red wand.	b. Aircraft is down for weapons.	b. Acknowledge with similar signal.
SAFING			
1. Safing supervisor: Hands over the head with fingers touching.	Red wands over the head with tips touching.	Pilot: Check all armament switches OFF or SAFE.	Pilot: Execute. Raise both hands into view of safing supervisor after checking switch positions. (Hands remain in view during safing.)
2. Safing supervisor points at crew member.	Same as day only with red wand.	Crew: Safe weapons (as applicable).	Crew: Execute.
3. Safing supervisor give pilot: Thumbs-up.	Red vertical wand.	Pilot: Aircraft is safed and crew and equipment are clear.	Pilot: Acknowledge with similar signal.

Figure 7-11. Arming and Safing Signals

Signal		Meaning	Response
Day	Night		
P/C rapidly fans hand in front of face and points to wheel with other hand.	Same, except with wand.	Your aircraft has hot brakes.	Comply with local hot brakes procedures.
P/C extends arms bent 90 degrees so hands are level in front of chest. Place right palm on top of left hand and with positive movement raise right hand and lower left hand.	Same, except make signal with wands.	Can I move EXT/INT switch to EXT position?	DAY: Pilot give "thumbs-up" (YES) or "thumbs-down" (NO). NIGHT: Same, except pilot moves horizontally held flashlight up and down several times (YES) vice "thumbs-up" signal, or left and right several times (NO) vice "thumbs-down" signal.

Figure 7-12. Postflight Ground Crew to Pilot Signals

SECTION VIII
ARMAMENT SYSTEMS

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ARMAMENT EQUIPMENT

General

This section describes the minimum armament equipment required to release external stores carried in a nontactical environment and a basic description of the gunsight. A complete description of the aircraft weapons system is contained in NAVAIR 01-40AV-1T, A-4/TA-4 Tactical Manual. This flight manual is incomplete without the tactical manual.

The aircraft is capable of carrying a wide variety of ordnance. All stores are carried externally on five racks. A four-hook ejector bomb rack is installed on the centerline (fuselage) station, and a two-hook bomb ejector rack is installed on each of the four wing stations. The centerline rack (AERO-7A) can be used to carry stores requiring either 30- or 14-inch suspension. Wing racks (AERO-20A) are provided with 14-inch suspension only.

Armament Controls

The cockpit includes an armament panel, control stick armament switches, emergency stores release handle, gunsight, and a gunsight reticle light control panel. Controls used with specific weapon systems (SHRIKE, WALLEYE, etc) are covered in the A-4/TA-4 Tactical Manual (NAVAIR 01-40AV-1T).

BULLPUP ADAPTIVE CONTROL (ARN-77)

On A-4E aircraft reworked per A-4 AFC 256, the BULLPUP adaptive control (ARN-77) is installed (figure FO-1). Any further description of this equipment will be covered in A-4/TA-4 Tactical Manual, NAVAIR 01-40AV-1T.

ARMAMENT PANEL

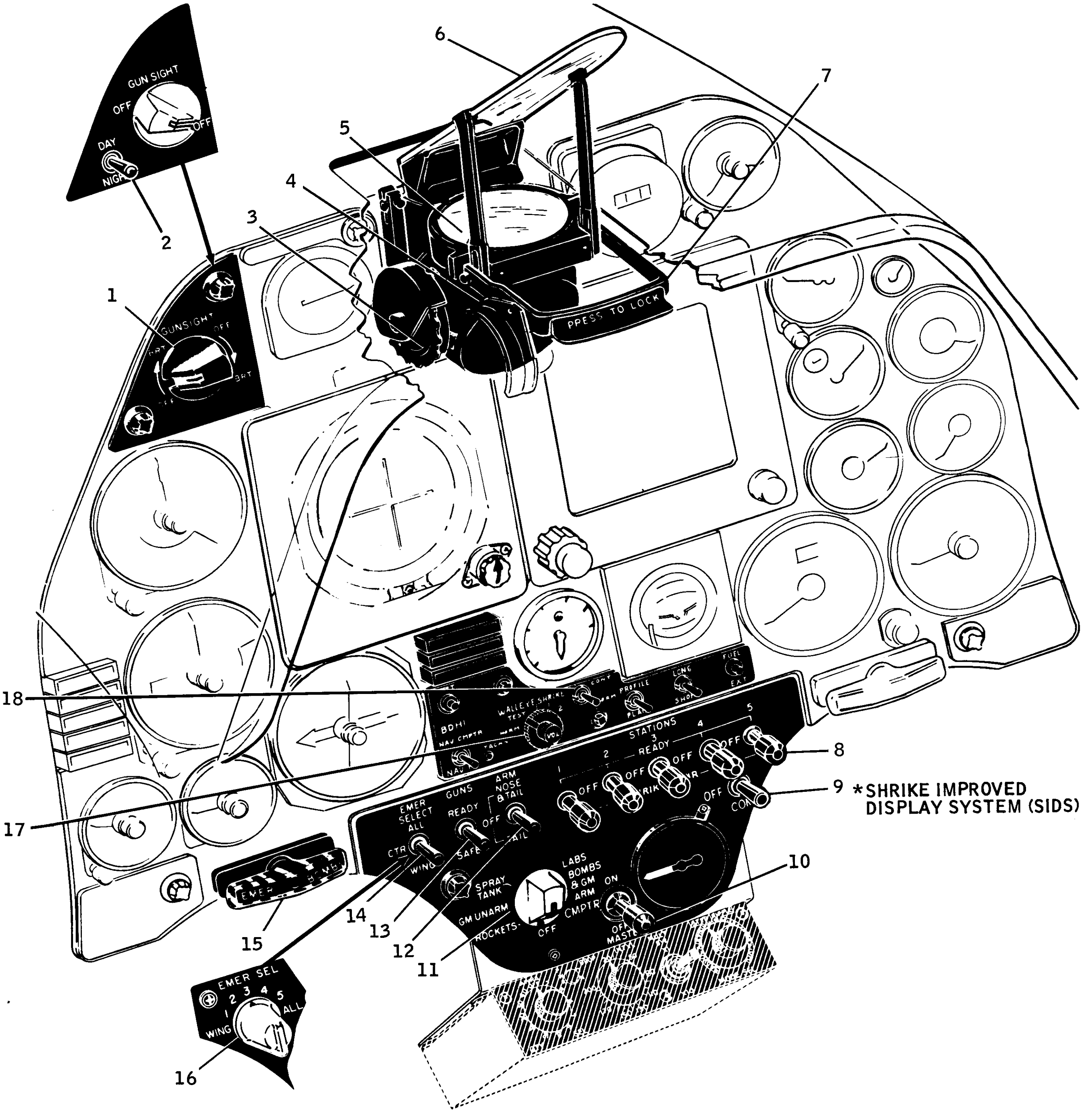
The armament panel (figure 8-1) is located below the instrument panel. Armament panel controls consist of the MASTER armament switch, STATIONS select switches, function selector switch, bomb ARM switch, GUNS switch, and EMER SELECT switch.

MASTER ARMAMENT SWITCH. All armament circuits are controlled by the MASTER armament switch (figure 8-1) with the exception of gun charging and emergency jettisoning of external stores. The MASTER armament switch must be in the ON position to energize armament circuits.

NOTE

- When the landing gear handle is in the DOWN position, an armament safety switch interrupts the power supply circuit to the MASTER armament switch and the gun charging circuit.
- When the aircraft is on the ground, an armament safety circuit disabling switch may be used to energize an alternate circuit for checking the armament system. This circuit is energized by momentarily closing the disabling switch located in the right-hand wheel well. Raising the landing gear or moving the MASTER armament switch to OFF will restore the armament safety circuit to normal operation.

STATIONS SELECT SWITCHES. Five STATIONS select switches (figure 8-1) provide for selection of any station or combination of stations for firing or release (except for emergency release). A number above each switch identifies the switch with the external station it controls. A-4E STATIONS select switches are three-position switches with positions marked OFF, READY, and SHRIKE PAIR. All A-4E STATIONS select switches prior to SHRIKE incorporation have positions marked OFF, READY, and SALVO. In A-4E modified for AWE-1 or "limited"



1. GUNSIGHT LIGHT CONTROL
2. GUNSIGHT DAY-NIGHT SWITCH
3. GUNSIGHT ELEVATION CONTROL
4. ELEVATION CONTROL GUARD
5. GUNSIGHT
6. GUNSIGHT REFLECTOR PLATE
7. ELEVATION CONTROL LOCKING YOKE
8. STATIONS SELECT SWITCHES
9. * SIDS CONTROL SWITCH (EARLY A-4E)
10. MASTER ARMAMENT SWITCH
11. FUNCTION SELECTOR SWITCH
12. BOMB ARMING SWITCH
13. GUNS SWITCH
14. EMERGENCY SELECTOR SWITCH
15. EMERGENCY STORES RELEASE HANDLE
16. EMERGENCY SELECTOR SWITCH
17. WALLEYE NORM TEST SWITCH (A-4 AFC 318)
18. SIDS CONT-NORM MODE SWITCH (LATE A-4E, ALL A-4F)

GG1-18-B

Figure 8-1. Armament Controls

SHRIKE missile, "full" SHRIKE, or SIDS (early A-4E aircraft reworked per A-4 AFC 376; late A-4E and all A-4F reworked per A-4 AFC 386), the switch positions are changed. (See figure 8-1 and refer to NAVAIR 01-40AV-1T, A-4 Tactical Manual.) SHRIKE configured aircraft have the SALVO position replaced by a SHRIKE PAIRS position. In AWE-1 configured aircraft, the SALVO position functions in the same manner as the READY position; therefore, the SALVO position serves no useful purpose and should not be used.

FUNCTION SELECTOR SWITCH. The function selector switch (figure 8-1) is an eight-position rotary-type switch. In aircraft prior to rework of A-4 AFC 319A, six of eight detented positions are identified, while two positions (12 and 5 o'clock positions) are unidentified and unused. Starting clockwise from the bottom, positions are identified OFF, ROCKETS, GM UNARM, SPRAY TANK, LABS, and BOMBS & GM ARM. In A-4E/F aircraft reworked per A-4 AFC 319A, seven of eight detented positions are identified, while one position (12 o'clock position) is unidentified and unused. Starting clockwise from the bottom, positions are identified as OFF, ROCKETS, GM UNARM, SPRAY TANK, LABS, BOMBS & GM ARM, and CMPTR. A stop prevents the switch from being rotated clockwise to the OFF position; therefore, the switch must be rotated counterclockwise to return to the OFF position.

BOMB ARM SWITCH. The bomb ARM switch (figure 8-1) is a three-position toggle switch with positions labeled NOSE & TAIL, OFF, and TAIL. Placing the switch in the NOSE & TAIL position energizes the nose and tail mechanical bomb arming units on each ejector rack. When in the TAIL position, only the tail arming unit on the ejector rack is energized. A mechanical bomb arming unit, when energized, locks onto the upper end of the arming wire, causing the arming pin to be withdrawn as the bomb falls from the aircraft. When the arming switch is in the OFF position, the mechanical arming units are not energized permitting the arming wires to fall with the bomb, and the bomb falls unarmed.

GUNS SWITCH. The GUNS switch (figure 8-1) is a two-position toggle switch with positions identified SAFE and READY. When the switch is in the SAFE position, the breechblock of each gun is in an out-of-battery position and the guns are inoperative. When in the READY position, the gun charging and firing circuits are completed, making the guns ready for firing.

EMERGENCY SELECTOR SWITCH. The emergency selector switch, identified EMER SELECT (figure 8-1), is a three-position toggle switch with positions labeled ALL, CTR, and WING. The switch provides selection of the external stores to be jettisoned when the emergency stores release handle is pulled. The emergency selector switch functions with the main or emergency generator in operation.

In A-4E/F aircraft reworked per A-4 AFC 344, the emergency selector switch is a rotary-type switch providing selection of WING, 1, 2, 3, 4, 5, or ALL stations when the emergency stores release handle is pulled.

CONTROL STICK ARMAMENT SWITCHES

BOMB RELEASE BUTTON. The bomb release button, often referred to as the "pickle" switch, is located on the left side of the control stick grip and is identified with the letter "B." The bomb release button functions only when operating on the main generator.

GUN-ROCKET TRIGGER. The gun-rocket trigger is located on the front of the control stick grip and is the initiator of gun and/or rocket firing when the proper conditions are established. When depressed, the gun-rocket trigger fires guns and/or rockets in any one of three arrangements: (1) With the function select switch set in OFF and the GUNS switch in READY, the guns are fired. (2) With the function select switch set in ROCKETS and the GUNS switch in SAFE, the rockets will be fired from all stations that have the STATIONS select switches set in READY. (3) With the function select switch set in ROCKETS and the GUNS switch in READY, the guns will fire and all rockets will fire from stations that have the STATIONS select switches set in READY. The gun-rocket trigger functions only when operating on the main generator.

EMERGENCY STORES RELEASE HANDLE. An emergency stores release handle, identified EMER BOMB (figure 8-1), is located on the lower left side of the instrument panel. Pulling the handle closes a switch in the emergency release circuit, bypassing the normal release controls. Power to the emergency circuit is supplied by the primary bus which is energized by either the main or emergency generator. Stores selected by the EMER SELECT switch may be released regardless of the position of the landing gear control or MASTER armament switch.

EXTERNAL STORES RELEASE. Release of external stores from the ejector-type racks is accomplished by electrical detonation of cartridges. When cartridges are fired by pressing the bomb release button, the initial force is an upward thrust which opens the hooks, followed by a downward ejector thrust of several inches which forces the store clear of the aircraft. An ejector foot is located aft of center on the bomb rack to counteract the twisting moment of the bomb caused by

drag forces in high-speed flight. Each ejector rack contains two cartridges; both are fired by either the normal or emergency release circuit.

NOTE

Normal release of external stores is possible only while operating on main generator. Emergency release may be accomplished while operating on the main or emergency generator.

Normal Release

1. Function selector switch ...... BOMBS & GM ARM
2. STATION select switches (as desired) .... READY
3. MASTER armament switch ..... ON
4. Bomb release button .... DEPRESS

NOTE

For releasing stores in an inert condition, the bomb ARM switch (controlling mechanical arming circuits) must be in the OFF position and/or the function selector switch on the AN/AWW-1 fuze function control panel (controlling electrical arming circuits) must be in the SAFE position.

Emergency Release

1. EMER SELECT switch ...... AS REQUIRED
2. Emergency stores release (EMER BOMB) handle .... PULL

CAUTION

When the emergency stores release handle is used to jettison wing stores only (EMER SELECT switch set in WING) ensure that STATION select switch for the centerline station is in the OFF position to prevent electrical feedback through the normal bomb release circuit and inadvertent release of the center store.

Gunsight

A lighted gunsight (figure 8-1) is located directly above the instrument panel. Gunsight controls include an elevation control knob, an elevation control locking yoke, and a gunsight reticle light control.

Light is beamed through a condenser lens and a ladder-type (fixed) reticle upward through a collimating lens to a reflector plate where it is superimposed upon the target. When using the gunsight with guns or rockets, the proper ballistic drop of the projectile is set into the gunsight as down lead. The center of the reticle image is kept on the center of the target, provided it is a fixed target. If the target is moving, the required lead angle must be established by using the graduations on the reticle.

The gunsight elevation control knob is located on the left side of the gunsight and is used to adjust the angle of the glass reflector for increasing or decreasing lead angle. Prior to changing lead angle with the elevation control, the locking yoke must be lifted to an unlocked position. The gunsight elevation control knob on aircraft reworked per A-4 AFC 451 has improved braking action on sight elevation adjustment mechanism to prevent loss of boresight through flight vibration or landing shock.

CAUTION

Failure to completely unlock the yoke prior to rotating the elevation control knob may damage the mechanism and result in sight elevation errors.

After setting the elevation control knob to the desired lead angle, the locking yoke must be pressed firmly against the sight body in the locked position.

CAUTION

When moving the yoke into the locked position, do not press on the guard attached to the locking yoke.

GUNSIGHT RETICLE LIGHT CONTROL

The gunsight reticle light control (figure 8-1) is located on the upper left corner of the instrument panel. By rotating the control knob, either of two filaments may be selected for lighting. Light intensity can be adjusted between the OFF and BRIGHT positions for either filament.

On A-4E/F aircraft reworked per A-4 AFC 353-II, a two-position toggle switch labeled DAY-NIGHT is located adjacent to the gunsight reticle light control. When the switch is in the DAY position, a gunsight light resistor circuit (also added per A-4 AFC 353-II) is bypassed allowing maximum power to the gunsight reticle light control rheostat. With the switch in the NIGHT position, power is directed through the gunsight light resistor circuit, resulting in lower light intensity variance controlled by the reticle light control rheostat.

SECTION IX
FLIGHT CREW COORDINATION

(Not Applicable)

SECTION X
NATOPS EVALUATION

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NATOPS EVALUATION

Concept

The standard operating procedures prescribed in this manual represent the optimum method of operating A-4/TA-4 aircraft. The NATOPS Evaluation is intended to evaluate compliance with NATOPS procedures by observing and grading individuals and units. This evaluation is tailored for compatibility with various operational commitments and missions of both Navy and Marine Corps units. The prime objective of the NATOPS Evaluation program is to assist the unit commanding officer in improving unit readiness and safety through constructive comment. Maximum benefit from the NATOPS program is achieved only through vigorous support of the program by commanding officers as well as flight crewmembers.

Implementation

The NATOPS Evaluation program shall be carried out in every unit operating naval aircraft. The various categories of flight crewmembers desiring to attain/retain qualification in A-4/TA-4 aircraft shall be evaluated in accordance with OPNAV Instruction 3510.9 series. Individual and unit NATOPS evaluations will be conducted periodically; however, instruction in and observation of adherence to NATOPS procedures must be on a daily basis within each unit to obtain maximum benefits from the program. The NATOPS coordinators, evaluators, and instructors shall administer the program as outlined in OPNAVINST 3510.9 series. Evaluees who receive a grade of "Unqualified" on a ground or flight evaluation shall be allowed 30 days in which to complete a re-evaluation. A maximum of 60 days may elapse between the date the initial ground evaluation was commenced and the date the flight evaluation is satisfactorily completed.

NOTE

- Pilots possessing a current A-4/TA-4 NATOPS report form (OPNAV Form 3510-8) are considered qualified in all A-4/TA-4 models provided the applicable GROUND TRAINING REQUIREMENTS outlined in section II are met.
- Pilot attending a formal course of RCVW training shall be considered, as a minimum, conditionally NATOPS qualified for 1 year, provided all required phases of instruction are completed. If practical, RCVW graduates will be fully NATOPS qualified, ground and flight evaluations, upon completion of the required instruction. An appropriate entry of NATOPS qualification shall be made in the pilot's log book.

Definitions

The following terms, used throughout this section, are defined as to their specific meaning within the NATOPS program.

NATOPS EVALUATION

A periodic evaluation of individual flight crewmember standardization consisting of an open book examination, a closed book examination, an oral examination, and a flight evaluation.

NATOPS REEVALUATION

A partial NATOPS evaluation administered to a flight crewmember who has been placed in an "Unqualified" status by receiving an unqualified grade for any of his ground examinations or the flight evaluation. Only these areas in which an unsatisfactory level was quoted need by observed during a reevaluation.

QUALIFIED

Well standardized. Evaluee demonstrated highly professional knowledge of and compliance with NATOPS standards and procedures; momentary deviations from or minor omissions in noncritical areas are permitted if prompt and timely remedial action is initiated by the evaluee.

CONDITIONALLY QUALIFIED

Satisfactorily standardized. One or more significant deviations from NATOPS standards and procedures, but no errors in critical areas and no errors jeopardizing mission accomplishment or flight safety.

UNQUALIFIED

Not acceptably standardized. Evaluee fails to meet minimum standards regarding knowledge of and/or ability to apply NATOPS procedures; one or more significant deviations from NATOPS standards and procedures which could jeopardize mission accomplishment or flight safety.

AREA

A routine of preflight, flight, or postflight.

SUBAREA

A performance subdivision within an area, which is observed and evaluated during an evaluation flight.

CRITICAL AREA/SUBAREA

Any area or subarea which covers items of significant importance to the overall mission requirements, the marginal performance of which would jeopardize safe conduct of the flight.

EMERGENCY

An aircraft component, system failure, or condition which requires instantaneous recognition, analysis, and proper action.

MALFUNCTION

An aircraft component or system failure or condition which requires recognition and analysis, but which permits more deliberate action than that required for an emergency.

Ground Evaluation

Prior to commencing the flight evaluation, an evaluee must achieve a minimum grade of "Qualified" on the open book and closed book examinations. The oral examination is also part of the ground evaluation but may be conducted as part of the flight evaluation. To ensure a degree of standardization between units, the NATOPS Instructors shall use the bank of questions contained in this section in preparing portions of the written examinations.

OPEN BOOK EXAMINATION

The open book examination shall be composed of not less than 50 questions selected from the question bank. This examination should require extensive use of section XI Performance Data and provide a comprehensive review of the flight manual in general. No time limit.

CLOSED BOOK EXAMINATION

The closed book examination shall consist of not less than 50 questions selected from the question bank. No time limit.

ORAL EXAMINATION

The questions may be taken from this manual and drawn from the experience of the instructor/evaluator. Such questions should be direct and positive and should in no way be opinionated.

OFT/WST PROCEDURES EVALUATION

The OFT/WST (if available) will be utilized to evaluate the pilot's knowledge and performance of normal procedures and his reaction to simulated emergencies and malfunctions. In areas not served by OFT/WST facilities, the procedures check should be conducted in a cockpit orientation trainer. If neither of these devices is available, the procedures check should be conducted by oral examination and discussion with the examinee in the cockpit of the applicable A-4 model aircraft. The following list of procedures and conditions are those which will be simulated during the OFT/WST procedures evaluation whenever possible. Critical emergency procedures which require an immediate response are designated by an asterisk(*).

Interior Inspection (Pocket Checklist)

Engine Starting Procedures

1. Wet start
2. Clear engine
3. Fire during start*
4. Normal start
5. Oil pressure failure.

Ground Tests (Pocket Checklist)

Before Takeoff (Pocket Checklist)

Takeoff

1. Aborting takeoff (fire, thrust loss, runaway trim). *

After Takeoff

1. Retraction release solenoid inoperative
2. Unsafe nose gear indication after gear retraction
3. Flameout below 250 KIAS after gear retraction. *

During Flight

1. Fuel transfer pump failure
2. Fuel tank float valve sticks closed
3. Fuel boost pump failure
4. Oil pressure failure (low, fluctuation, out)
5. Runaway aileron trim
6. Main generator failure
7. Flight control hydraulic failure only
8. Complete loss of both hydraulic systems
9. Speedbrake failure
10. Loss of oxygen supply
11. Engine failure above 20,000 feet
12. Fire warning light ON and remains ON (other indications of fire)
13. Maximum glide
14. Ejection*
15. Bailout
16. Ac-dc power converter
17. Electrical fire in flight
18. EGT and/or rpm failure
19. Gyro horizon failure
20. Runaway elevator trim
21. Fuel quantity gage failure (rotates)
22. Engine icing
23. The 300-gallon drop tank on wing station will not transfer.
24. Loss of airspeed indicator
25. Surging engine (rpm and EGT) or loss of thrust
26. Fuel flow fluctuation/failure
27. Fire warning light ON (no other indications)
28. Throttle linkage failure
29. Smoke/fumes in cockpit
30. Air conditioning goes full-hot
31. Smoke/fumes in cockpit in RAM position
32. Runaway rudder trim
33. Ditching (land/sea).

Pretraffic Pattern Checklist

1. Utility hydraulic system failure.

Traffic Pattern Checklist

1. Loss of wheel brake(s)
2. Unsafe main or nose gear indication
3. One main gear up.

Landing and Rollout

1. No airspeed indicator
2. Runaway nosedown trim.

Stopping the Engine

Before Leaving the Aircraft

GRADING INSTRUCTIONS

Examination grades shall be computed on a 4.0 scale and converted to an adjective grade of "Qualified" or "Unqualified."

On the Open Book examination, the evaluee must obtain a minimum score of 3.5 to obtain a grade of "Qualified."

On the Closed Book examination, the evaluee must obtain a minimum score of 3.3 to obtain a grade of "Qualified."

On the Oral examination and OFT Procedure Check (if conducted), a grade of "Qualified" or "Unqualified" shall be assigned by the instructor/evaluator.

Flight Evaluation

The number of flights required to complete the flight evaluation should be kept to a minimum; normally, one flight. The areas and subareas to be observed and graded on a flight evaluation are outlined in the grading criteria with critical areas designated. Subarea grades will be assigned in accordance with the grading criteria. These subareas shall be combined to arrive at the overall grade for the flight. Area grades, if desired shall also be determined in this manner.

NOTE

Critical areas or subareas are indicated by an asterisk (*) or are outlined in mission evaluation.

The flight evaluation will be flown in daylight conditions to facilitate observations and grading by the instructor/evaluator; however, instrument conditions may be encountered if desired.

OFT/WST procedures evaluation may be substituted for the flight evaluation at the Commanding Officer's discretion.

SAFETY CONSIDERATIONS DURING EVALUATION FLIGHTS

Due to the broad significance of safety, it is impractical to list all contingencies without at the same time developing a lengthy and voluminous grading criteria. Generally, mission success is subject to compromises due to safety infractions, violations, omissions, or deviations, beginning with Mission Planning and ending with the Postflight Debriefing. The following paragraphs provide additional guidance in these areas.

(1) Violations of Pertinent Directives or Procedures which have a direct bearing on the safe completion of the mission or negligence in following any procedure or directive to the extent of jeopardizing the safety of the pilot or aircraft will constitute an overall grade of "Unqualified." The degree of jeopardy involved, in the absence of specific criteria, must be an evaluator/instructor determination based on experience and good judgement.

(2) The Latitude Given Evaluators/Instructors in Grading Safety Items must be exercised with care. They should avoid assumptions in concluding that a safety discrepancy exists. To reason that a safety discrepancy could possibly occur as a result of a remote set of circumstances is unfair to the pilot being evaluated.

(3) When an In-flight Safety Discrepancy is Evident or is dangerously imminent, and the pilot appears to be unaware of the condition or has not taken appropriate action, the evaluator/instructor will correct the situation by directing or taking the necessary corrective action immediately. Safety of flight will not be compromised due to any reluctance on the part of the evaluator/instructor to correct the discrepancy.

(4) If a Grade of "Unqualified" is Given, a brief descriptive statement concerning the safety discrepancy will be entered on the Evaluation Report Form. The statement should be recorded "Safety Discrepancy."

USE OF JUDGMENT OF NATOPS EVALUATION FLIGHTS

The grading criteria establish standards for grading pilot performance, but this does not relieve the evaluator/instructor from using good judgment based upon experience. In those items where a pilot fails to meet the minimums set forth in the grading criteria but the evaluator/instructor, through past experience and judgment, knows the error to be caused by contributing factors such as weather, turbulence, etc, he may assign the pilot a grade of "Qualified." However, the reason for such action must be recorded on the worksheet and Report Form. If the pilot being evaluated consistently made poor or wrong decisions, a statement to this effect will be reflected on the worksheet and the Remarks portion of the Report Form, regardless of whether or not the pilot successfully completed the Evaluation. The only way the final grade and degree of performance of the pilot can be determined is by use of the grading criteria. Unless an obviously unsafe act has been observed (which would automatically and immediately terminate the flight), the evaluator/instructor should not attempt to determine during the flight if the evaluee passes or fails.

MINOR DISCREPANCIES AND/OR OMISSIONS

Minor discrepancies and/or omissions are defined as those which will not adversely affect the successful completion of the mission or jeopardize the safety of the pilot and/or aircraft.

MOMENTARY DEVIATIONS

Deviations from the tolerances set forth in the grading criteria which are momentary in nature will not be considered in grading, provided the evaluee is alert in applying corrective action, the deviation does not jeopardize the safety of the pilot or aircraft, and the deviation does not exceed the limitations prescribed for a conditionally qualified grade. Cumulative momentary deviations will result in downgrading.

FLIGHT EVALUATION AREAS

Mission Planning

1. Flight plan
2. Weather.

Briefing

Preflight

1. Records check
2. Preflight check. *

Start/Poststart

1. Start
2. Poststart procedures.

Taxi/Runup

1. Taxi
2. Engine runup
3. Clearances.

Takeoff*

1. Procedures.

Climb/Cruise

1. Climb schedule
2. Transition
3. Enroute procedures.

Approach and Landings*

1. Pattern entry
2. Approach.

Emergency Procedures

1. Simulated emergencies may be given.

Shutdown/Postflight

1. Shutdown*
2. Postflight inspection
3. Yellow sheet
4. Debriefing .

MISSION EVALUATION AREAS

Rendezvous

1. Procedures.

Weapons

1. Target procedures
2. Rendezvous procedures.

Navigation

1. Low level
2. Medium level.

Flight Evaluation Grading Criteria

Only those subareas provided or required will be graded. The grades assigned for a subarea shall be determined by comparing the degree of adherence to standard operating procedures with adjectival rating listed below. Momentary deviations from standard

operating procedures with adjectival rating listed below. Momentary deviations from standard operating procedures should not be considered as unqualifying provided such deviations do not jeopardize flight safety and the evaluee applies prompt corrective action. The NATOPS evaluation flight is intended to evaluate unit/individual compliance with approved standardized operating procedures. The successful completion of all ground checks and examinations is required before commencement of the flight evaluation. Insofar as possible, checks will be scheduled so as not to interfere with squadron operations. The flight evaluation check should conform to any syllabus flight. Only those areas observed, or required by the mission assigned, will be evaluated. The flight evaluation grade will be attained by comparing the degree of pilot(s) adherence to standard operating procedures with the adjective ratings as outlined for individual areas and subareas of this section. Determination of the final flight evaluation grade will be made as outlined in FINAL GRADE DETERMINATION.

Flight Evaluation Grade Determination

The following procedure shall be used in determining the flight evaluation grade.

A grade of "Unqualified" in any critical area/subarea will result in an overall grade of "Unqualified" for the flight. Otherwise, flight evaluation (or area) grades shall be determined by assigning the following numerical equivalents to the adjective grade for each subarea. Only numericals 0, 2, or 4 will be assigned in subareas. No interpolation is allowed.

Unqualified 0.0

Conditionally Qualified 2.0

Qualified 4.0

To determine the numerical grade for each area and the overall grade for the flight, add all the points assigned to the subareas and divide this sum by the number of subareas graded. The adjective grade shall then be determined on the basis of the following scale.

0.0 to 2.19 - Unqualified

2.2 to 2.99 - Conditionally Qualified

3.0 to 4.0 - Qualified

Example: $\frac{4+2+4+2+4}{5} = \frac{16}{5} = 3.20$ or Qualified

Final Grade Determination

The final NATOPS evaluation grade shall be the same as the grade assigned to the flight evaluation. An evaluee who receives an "Unqualified" on any ground examination or the flight evaluation shall be placed in an "Unqualified" status until he achieves a grade of "Conditionally Qualified" or "Qualified" on a reevaluation.

RECORDS AND REPORTS

The NATOPS Evaluation Report, OPNAV Forms 3510-8, shall be completed for each evaluation conducted and shall be forwarded to the evaluee's Commanding Officer only. This report shall be filed in the individual flight training record and retained therein for 18 months.

An entry shall be made in the Pilot/NFO Flight Log Book under "Qualifications and Achievements" as follows:

NATOPS EVAL.	(AIRCRAFT MODEL)	(CREW POSIT.)	(DATE)	(AUTHENTICATING SIGNATURE)	(UNIT WHICH ADMINISTERED EVAL.)

In the case of enlisted flight crewmembers. an entry shall be made in the administrative Remarks section of his Personnel Record upon satisfactory completion of the NATOPS Evaluation as follows:

(DATE) Completed a NATOPS Evaluation in (aircraft designation) as (flight crew position) with an overall grade of (Qualified or Conditionally Qualified).

A4-E/F NATOPS QUESTION BANK

The following bank of questions is intended to assist the unit NATOPS instructor/evaluator in the preparation of ground examinations and to provide an abbreviated study guide. The questions from the bank may be combined with locally originated questions in the preparation of ground examinations.

A-4E/F NATOPS Question Bank

1. How is the 80 percent sensing circuit of the oil quantity indicator/switch checked?
2. With a throttle linkage failure how can the engine be secured?
3. Describe the functioning of the fuel quantity indicator after a failure of the dc converter.
4. When external electrical power is not available during pressure fueling, what precautions must be taken to prevent possible damage to the internal fuel tanks structure?
5. Can a short circuit in the fire-detection system be detected by the pilot? If so, how?
6. Where are the hydraulic system pressure gages located?
7. List the components operated by the utility hydraulic system.
8. What is the purpose of the rotary viscous dampers on the ailerons and rudder?
9. What caution must be observed when operating the horizontal stabilizer manual override lever?
10. In the event of a utility hydraulic system failure, what prevents the landing gear from extending when hydraulic pressure is lost?
11. What is the purpose of the aileron followup trim tab?
12. What is the purpose of the retraction release safety-solenoid?
13. What prevents spoiler operation during flight?
14. What caution should be observed after the emergency landing gear handle has been pulled?
15. What is the purpose of the vortex generators?
16. Can the arresting hook be lowered after a complete hydraulic failure?
17. What warning must be observed to avoid injury when the canopy is jettisoned in flight?
18. What is the best method of ensuring that the canopy is closed and latched?
19. Can the canopy be jettisoned in the open position by pulling the canopy jettison handle?
20. What is the purpose of the DART system?
21. If the pilot separates from the seat manually (by use of the harness release handle) will the parachute deploy automatically?
22. Where is the gyro cutout switch located?
23. What is the maximum length of time that the fast erect switch may be pressed without damaging the circuitry?
24. How is the angle-of-attack indexer lighting integrity checked?
25. What switch activates the angle-of-attack vane heater?

A-4E/F NATOPS QUESTION BANK (Continued)

26. Where is the UHF communication antenna located?
27. How many reply codes is the AN/APX-64 system capable of providing in Mode 3/A? (A-4F)
28. How many minutes warmup should be allowed before switching TACAN from REC to T/R?
29. What NAVAIDS are available on the emergency generator?
30. What prevents frosting of the bullet-resistant glass center panel of the windshield?
31. What precaution must be taken to prevent the windshield center panel from fogging when the emergency generator is extended?
32. What action should be taken if rpm exceeds 101 percent during flight?
33. If oil pressure exceeds 50 psi in flight, what action should be taken?
34. With fuel in the 300-gallon external fuel tanks, what limitations must be observed when performing aileron rolls?
35. During taxi, what indications would the pilot have if nose strut were overinflated?
36. What signal should pilot use to cut off starting air to engine?
37. What effect will shutting down the engine at touchdown have on reducing landing roll? Why?
38. Describe "gouge" for proper parade formation bearing.
39. Describe "gouge" for proper freecruise formation bearing.
40. If a successful takeoff is made with a blown tire, what precautions should be taken?
41. In the event of a confirmed engine failure during catapult launch, what action should be taken?
42. After takeoff the nosegear indicates unsafe with the landing gear handle up and both main gear indicating UP. What should you do?
43. What action is recommended when a loss of thrust occurs and icing is suspected?
44. You're cruising at FL 310 and suddenly experience fluctuating EGT, fuel flow, and EPR. What would you do?
45. Off your third bombing run, the oil quantity light comes on steady. What action would you take?
46. What indication would you have of failure of the engine-driven fuel pump?
47. During flight you get dense smoke in the cockpit. You select RAM air and find no evidence of fire but the smoke becomes so dense that you can't see. What would you do?
48. You are climbing through 1200 feet off the catapult and accelerating through 230 KIAS when a flameout occurs. What action would you take?
49. During extended ground operations (in excess of 30 minutes), what must be done to prevent damage to the AN/ASQ-17? (A-4E)

FILL IN THE BLANKS

1. The aircraft is powered by a ______________________ gas turbine engine producing a sea-level static thrust rating of __________ pounds.
2. Basic weight (to nearest 50 pounds) is __________ (total operating weight from figure 11-1).

A-4E/F NATOPS QUESTION BANK (Continued)

3. Wingspan is ______________ feet.

4. The total temperature sensor is located ____.

5. The engine utilizes a split ____________ stage axial compressor.

6. There are __________ combustion chambers. Numbers ___ and ___ have spark igniters.

7. For engine starting, the timer energizes the high-power ignition unit supplying _________ joules to both igniters for a ______ to ______ second firing cycle.

8. The manual fuel control system compensates only for ____.

9. When shifting the engine fuel control from PRIMARY to MANUAL below 225 KIAS, select a minimum throttle setting of _________ percent rpm.

10. During a normal start the manual fuel control warning light will go out at about ___ to ___ percent rpm.

11. The tachometer indicates the speed of the ___________ -pressure compressor rotor (N____) as a percentage of ________ rpm.

12. The pressure ratio indicator provides the ratio of ______ pressure to pressure at the ____.

13. The pressure ratio indicator should be read at _______ airspeed.

14. In the high thrust range an increase of only ________ °C may double the rate of turbine blade creep.

15. The oil cooler employs ________________________________ as a coolant.

16. Maximum oil consumption is approximately _________ quarts per hour.

17. Absence of oil pressure is permissible for a maximum of _________ seconds.

18. A fuel sump with flapper valves will provide fuel during inverted or negative-g flight for approximately ________ seconds.

19. The wing tank transfer pump utilizes ____ for power.

20. The fuel transfer caution light will be on when engine rpm is below ________ percent rpm.

21. Approximate fuel transfer rates from the drop tanks (90 percent power setting) are: ____________ pph from SL to 5000 feet MSL and ____________ pph from 25,000 to 35,000 feet MSL.

22. The emergency transfer system allows ____ to pressurize the ____.

23. List the usable fuel in pounds for the following: (standard day, JP-5, pressure fueling)

Fuselage __________

Wing ________

Two 300-gallon droptanks __________

Total ___________

24. Indicated airspeed for most accurate fuel reading is ________ KIAS.

25. When fuselage tank quantity drops to about _______ pounds, wing fuel cell quantity will not be indicated on the fuel quantity indicator.

A-4E/F NATOPS QUESTION BANK (Continued)

26. Electrical power is normally supplied by a ______ KVA engine-driven generator which furnishes ______ / ______ volt ______ phase ______ cycle constant-frequency ac power.

27. The emergency generator is rated at ______ KVA.

28. The main generator is driven at a constant speed of ______ rpm.

29. The emergency generator is driven by a variable-pitch propeller at approximately ______ rpm and provides power to the ______ and ______ buses.

30. The emergency generator bypass switch should be in the ______ position for normal flight operations.

31. While operating on emergency generator, actuation of ______ or ______ will divert power from the monitored primary bus.

32. Fuses are located on three panels. Two of them located ______ and the other located ______.

33. The hydraulic systems operate at a pressure of about ______ psi and relief valves open at ______ psi.

34. When the speedbrakes are opened, the control stick moves ______.

35. The rudder system operates at a reduced hydraulic pressure of ______ psi.

36. Total travel of the rudder trim position indicator represents ______ degrees of travel left and right of center.

37. List all possible cockpit indications of an unsafe landing gear condition.

   a. ______

   b. ______

   c. ______

38. List the conditions necessary to activate the nosewheel steering system (A-4F)

   a. ______

   b. ______

   c. ______

   d. ______

   e. ______

39. During ground operations with the nosewheel steering switch in NORMAL and the arresting hook handle DOWN, and the stick button not depressed, the nosewheel will be ______ ______. (A4-F)

40. With full right rudder trim, the nosewheel will steer ______ degrees right and ______ degrees left. (A4-F)

41. The wing flaps are ______ controlled, ______ actuated and extend ______ degrees when full DOWN.

42. The speedbrakes begin to blow back at ______ KIAS and will not open fully above ______ KIAS.

43. The wing slats begin to open at some airspeeds below ______ KIAS and are fully opened at ______.

44. Normal arresting hook snubber pressure is ______ psi.

A-4E/F NATOPS QUESTION BANK (Continued)

45. Pulling the canopy jettison handle fires an initiator which in turn activates a ______ ______ causing high pressure ______ to escape into the ______ ______ ______ which jettisons the canopy.

46. The automatic barometric parachute openers are set to operate at ______ feet altitude.

47. When the harness release handle is pulled up, the ______ ______ lanyard and the ______ and ______ attachments are released from the seat allowing the pilot to leave the cockpit with the ______ and ______ still attached to his torso harness.

48. Sea level liquid oxygen duration is about doubled at ______ feet altitude, increased four times at ______ feet altitude and increased ______ times at 40,000 feet altitude.

49. The emergency oxygen cylinder pressure gage should register ______ psi when full.

50. The emergency oxygen supply will last from ______ to ______ minutes depending on altitude.

51. Pitot-static system instruments are:

a. ______

b. ______

c. ______

52. Electrically operated flight instruments are:

a. ______

b. ______

c. ______

d. ______

e. ______

53. A maximum of ______ seconds may be required for gyro erection and amplifier warmup.

54. On the BDHI, needle No. 1 will always indicate ______ bearing, however, if the compass card is out of "sync" needle No. 2 will indicate ______ bearing only.

55. Maximum endurance is obtained at ______ units angle-of-attack (with two 300-gallon tanks).

56. Optimum angle-of-attack setting should be ______ units.

57. The approach light arresting hook bypass switch is located ______ ______ ______.

58. The squelch-disable switch should normally be placed in the ______ position. (A-4F)

59. A compass card error of ± ______ degrees will peg the sync needle of the compass controller.

60. For A/A TACAN operation, the cooperating aircraft must be separated by exactly ______ channels.

61. A/A TACAN may be utilized by one lead aircraft and up to ______ others.

A-4E/F NATOPS QUESTION BANK (Continued)

62. To check the ASN-41, rotate function selector to TEST and place BDHI switch to NAV CMPTR. Proper indications are:

WIND SPEED ________

WIND DIRECTION ________

LAT PRESENT POSIT ________________ integration

LONG PRESENT POSIT ________________ integration

BDHI No. 2 pointer ________________

BDHI No. 1 pointer ________________

63. To check APN-153, allow ______ minute(s) warmup in STBY, then switch to TEST. Proper indications are:

Memory light ____

Groundspeed ____

Drift angle _____

64. Ranges provided by the APG 53A are as follows:

Mode	Short	Long
SRCH	____ miles	____ miles
T/C	____ miles	____ miles
A/G	____ yards	____ yards

65. In the T/C PROFILE mode of the radar, proper use of the detail control reduces the vertical beam width to ________ degrees.

66. When flying 1000-foot terrain clearance at normal low level airspeeds, a crosswind component greater than ______ knots will displace the PROFILE mode scan off the ground track of the aircraft.

67. The AFCS will maintain a bank angle of ______ degrees in a preselected heading turn.

68. Warm-up period of the AFCS is _____ to _____ seconds.

69. The AFCS altitude-hold switch cannot be engaged in climbs or descents in excess of ____________ fpm.

70. The AFCS will disengage from control stick steering mode when the ailerons are deflected over ______ ____________.

71. If the ladder lights are not visible in daylight, check the ____________________ switch(es) full OFF.

72. Normal cockpit pressurization schedule holds _____ feet cockpit altitude to an aircraft altitude of _____ feet.

73. With normal cockpit pressurization, cockpit altitude will be about ______ feet at an aircraft altitude of 20,000 feet, and ______ feet at an aircraft altitude of 35,000 feet.

74. In order to prevent excessive pressure differential in the cockpit, a relief valve opens at a positive pressure differential of ______ psi and at a negative differential of _____ psi.

75. For maximum use of the engine anti-icing system, the engine should not be operated below ____ percent rpm.

A-4E/F NATOPS QUESTION BANK (Continued)

76. Rain removal system operation at MILITARY power is limited to ________ minutes on the ground, and ________ minutes in flight.

77. The centerline refueling store contains a ________ gallon fuel cell.

78. The operational envelope of the store with the drogue extended is limited to ________ KIAS or ________ Mach, whichever is lower, at altitudes up to 35,000 feet.

79. The amber light on the aft end of the air refueling store comes on when ________________, and the green light comes on when ________________.

80. Actuating the air refueling store HOSE JETTISON switch removes all electrical power from the store controls except the ________________.

81. Do not start ground fueling operations within ________ feet of aircraft with radar equipment operating.

82. When pressure fueling by the alternate method, ________________ must be removed to prevent possible damage to wing integral fuel tank structure.

83. The fuel control selector is accessible through the engine ________________ access door.

84. Checking or filling the engine oil system should be accomplished within ________ minutes after engine shutdown. If not serviced within this period, the engine must be turned up at 75 percent rpm or more for ________________ to establish actual oil tank level.

85. Engine oil spec is ________________.

86. The CSD utilizes ________________ fluid.

87. To start the aircraft, ________________ electrical power is required for ignition.

88. During start EGT exceeds ________ °C ________ times, or reaches ________ °C to ________ °C for one period of ________ seconds or more, engine must be subjected to an overtemperature inspection. An EGT exceeding ________ °C for any period of time will require a teardown inspection of all hot section parts.

Operating Condition	Max Egt °C	Max rpm Percent	Time Limit
Idle			
Acceleration			
Normal			
Military			

89. If oil pressure indication is less than ________ psi at ________ percent rpm, shut down engine and investigate cause.

90. Maximum operating time with oil pressure less than 40 psi in flight is ________________.

91. Absence of oil pressure for a maximum of ________ seconds is permissible.

92. Normal oil pressure limits for flight are ________ psi to ________ psi.

93. The maximum permissible change in angle of bank during rolling pullouts or pushovers is ________________.

A-4E/F NATOPS QUESTION BANK (Continued)

NEW

94. Deleted.

95. Airspeed limitations with gear and flaps extended are ________ KIAS with zero yaw and ________ KIAS with unrestricted yaw.

96. The airspeed limitation on budy store hose retraction is ________ KIAS.

97. Airspeed limitations with flight controls disconnected are:

Asymmetrical Loading: ________ KIAS

Symmetrical Loading: ________ KIAS or ________ IMN whichever is lower.

98. The airspeed limitation with the emergency generator extended is ________ KIAS or ________ IMN whichever is lower.

99. The maximum recommended gross weight for field takeoff is ____________ pounds.

100. The maximum gross weight for field landing is ____________ with minimum rate of descent or ____________ pounds normally.

101. Maximum recommended catapult weight is ____________ pounds.

102. Carrier arrestment weight limitation is ____________ pounds.

103. The maximum recommended gross weight for barricade engagement is ____________ pounds.

104. Maximum asymmetrical load limitations are ________ foot-pounds for field takeoffs and carrier landing and ________ foot-pounds for carrier catapult launches.

105. Operation of the AFCS is unrestricted above ________ feet altitude.

106. Minimum altitude for operation of the AFCS is ________ feet.

107. HANDS OFF operation of the AFCS will be permitted between 1000 feet and 7500 feet, if ____________ ____.

108. At 18,000 pounds gross weight in symmetrical flight, structural acceleration limits are + __________ g and - __________ g.

109. Minimum requirements for night flying are: 1. ____________________
2. ____________________

110. Before actual instrument flight in the A-4, a pilot must have at least _____ hours in the A-4/TA-4 in the last _____ months, one flight within _____ days, a current instrument card, and demonstrated instrument proficiency in model.

111. On preflight, the arresting hook holddown cylinder pressure gage should read ____________ psi.

112. On a cart-controlled start, the pilot should signal to cut off the air supply at _____ to _____ percent rpm.

113. Engine should light off within ________ seconds after throttle is moved outboard to start ignition.

A-4E/F NATOPS QUESTION BANK (Continued)

114. Warmup time for electronic equipment is as follows:

ITEM	WARM-UP TIME
UHF Radio	______________
ARR-69 (A-4F)	______________
UHF/ADF	______________
TACAN	______________
IFF/SIF	______________
ASN-41	______________
APN-141	______________
AJB-3/A	______________
AFCS	______________
APG-53	______________
APN-153	______________

115. TACAN switch should be placed in REC position for ________ minutes before going to T/R position.

116. Minimum taxi interval is ________ feet, or taxi in close formation.

117. For aileron trim check, P/C should check followup tab ± ________ inch from faired with aileron trailing edge.

118. After takeoff raise the flaps at ________ KIAS or above.

119. Section takeoffs are not permitted with a crosswind component in excess of ________ knots.

120. Takeoffs are not recommended when the crosswind component exceeds ________ knots.

121. To accomplish a minimum run takeoff, ________________ noseup trim and ________________ flaps should be employed.

122. At a gross weight of 12,000 pounds recommended approach speed (optimum A0A) is ________ knots and increases ________ knots for each 1000 pounds increase.

123. Maximum recommended crosswind components for landing are:

With spoilers ________ knots.

Without spoilers ________ knots.

124. With a power boost disconnect, maximum crosswind component is ________ knots.

125. After touchdown on a crosswind landing the control stick should be placed ____.

126. Desired distance abeam in the FMLP pattern is ________ nautical miles.

127. After an FMLP touch and go landing, climb straight ahead until reaching at least ________ feet altitude and ________ KIAS.

128. During night VFR conditions the wingman should have ________________ lights on ________________, and the anticollision light ________________.

A-4E/F QUESTION BANK (Continued)

129. At the end of the catapult power stroke the aircraft should be rotated to approximately________ degrees on the attitude gyro.

130. During hot refueling at night, the emergency fuel cutoff signal is ________________________________.

131. Aboard ship, the plane captain must ____________________ upon completion of hot refueling. Drop tanks must be either ____________________ or ____________________.

132. A ____________________ is installed in the elevator control system to provide longitudinal load feel.

133. Above 0.9 IMN the elevator effectiveness ________________________________.

134. During recoveries from dives at supersonic speeds, a marked pitchup will occur at approximately ________ IMN.

135. The aircraft is subject to strong ____________________ tendencies above 0.9 IMN with flight control boost disconnected.

136. With flight control boost disconnected and asymmetric store loadings, the minimum initial approach airspeed is ________ KIAS and minimum final approach and touchdown is ________ KIAS.

137. Compute stalling speeds with speedbrakes retracted, gear down, takeoff thrust, and half flaps for the following gross weights:

12,000 pounds: ________ KIAS, 16,000 pounds: ________ KIAS 20,000 pounds: ________ KIAS

138. Compute stalling speeds with speedbrakes open, gear and full flaps down, and approach thrust, for the following conditions:

	BANK ANGLE		
GROSS WT	0	30	45
12,000			
14,000			
16,000			

139. During flight with aft CG locations (aft of 26 percent MAC), ____________________ may be encountered when applying load factor.

140. Do not select power settings below________ percent rpm at speeds below________ KIAS.

141. Eject if an inadvertent confirmed spin occurs below________ AGL.

142. Spin recovery techniques are as follows:

TYPE SPIN	RUDDER	AILERON	STICK
ERECT			
	------------ IF NO RESPONSE ------------		
INVERTED			

A-4E/F NATOPS QUESTION BANK (Continued)

143. Recovery from a fully developed spin requires ________ to ________ feet altitude with proper application of controls.

144. In uncontrolled flight, immediately after a full stall, the best control technique to prevent a spin is ________ ____.

145. Unless otherwise briefed, rendezvous are made at ________ KIAS.

146. The lead aircraft in a turning rendezvous should maintain ________ degrees of bank.

147. Proper rendezvous is ________ degrees, relative.

148. After engaging drogue, receiver aircraft must move forward ________ to ________ feet and extinguish amber light on the refueling store before fuel transfer can commence.

149. Maximum speed for unfeathering the air refueling store turbine is ________ KIAS.

150. Maximum speed for extension of the drogue and air refueling is ________ KIAS or ________ IMN.

151. Closure rates above ________ knots may induce hose whip.

152. Optimum airspeed for air refueling is ________ KIAS.

153. If fuel leaks from the probe after disengagement, the pilot should ____ ____.

154. Aircraft should maintain at least ________ feet lateral separation from the tanker during unfeathering or feathering of the air turbine.

155. During night formation flight, channel changes shall be made by ____ whenever possible.

156. A false start occurs when the time from lightoff to IDLE exceeds ________ seconds.

157. On a wet start the throttle should be retarded to OFF, being careful ____ ____.

158. List the initial procedures for an engine fire during start.

1. ____

2. ____

3. ____

159. The signal for brake failure on the flight deck is:

Day ____

Night ____

160. On a takeoff abort the hook should be dropped ________ feet prior to abort gear, if required.

161. With a fuel-boost pump failure, full power is available to ________ feet and possibly as high as ________ feet. Observe the following restrictions: ____ ____.

162. To shift fuel control from PRIMARY to MANUAL, throttle should be ____.

163. If engine oil pressure drops below 40 psi, gradually adjust engine speed to ____.

A-4E/F NATOPS QUESTION BANK (Continued)

164. Describe the AIRSTART procedures.

165. List three indications which may confirm a fire warning light indication.

166. Describe proper procedures to be taken with a fire warning light and other indications of fire.

167. Ejection is mandatory if the aircraft is in uncontrolled flight at ________ feet AGL or below.

168. While on the run-in line for an O/S loft delivery, the engine flames out. What would you do? ____________

If relight is not obtained, when would you eject? ____________

169. What does the zero delay lanyard do in the ejection sequence? ____________

170. Canopy can be unlatched manually and removed by the airstream if airspeed is above ________ KIAS.

171. Deploying the RSSK-8 seat pack is not recommended over ____________ (A-4F).

172. During any low altitude ejection, the pilot should ____________ ____________ immediately after ejection.

173. Determine terrain clearance for safe ejection for the following conditions:

Wings level, 90 to 200 knots, 800 fpm descent; ________ feet altitude.

Wings level, 90 to 200 knots, 4000 fpm descent; ________ feet altitude.

60-degree bank, 90 to 200 knots, 1000 fpm climb ________ feet altitude.

30-degree bank, 90 to 200 knots, 1500 fpm descent ________ feet altitude.

90-degree bank, 90 to 200 knots, level flight ________ feet altitude.

174. The recommended speed for maximum glide range with engine windmilling is approximately ________ KIAS for gross weights up to 14,000 pounds in the clean configuration. Increase airspeed ________ knots for each 1000 pounds increase over 14,000 pounds.

175. On a round-robin day instrument flight you suffer a bird-strike on missed approach from a GCA at an AFB. Your wingman determines that the bird hit the port side of the radome and did no visible structural damage. All engine instruments are normal and you have been cleared on your route to your home field 200 NM away. What would you do? ____________

176. If a hydraulic system is lost during flight, be alert for evidence of ____________

A-4E/F NATOPS QUESTION BANK (Continued)

177. Describe the flight control disconnect procedure.

____
____
____
____
____
____

178. What may happen if you deploy the emergency generator above 25,000 feet and 96 percent power? Why?

____
____

179. With a main generator failure and while operating on the emergency generator, which of the following systems will continue to operate?

UHF RADIO	ASN 19/41
TACAN	APPROACH LIGHTS
FUEL QUANTITY	NORMAL WEAPONS RELEASE
FIRE WARNING	AILERON TRIM
SPEED BRAKES	OIL PRESSURE DIRECT READING
NORMAL TRIM	UHF HOMER
AJB-3/3A	EMERGENCY BOMB RELEASE
WING LIGHTS	HORIZONTAL STABILIZER OVERRIDE
TRIM INDICATORS	WHEEL AND FLAP INDICATORS
IFF	ANGLE-OF-ATTACK INDICATOR

180. If the AFCS malfunctions and cannot be disengaged with the AP button on the control stick or by turning the AFCS switch OFF, you should: ____
____.

181. If normal aileron trim is not restored upon disengagement of the AFCS, what can you do to restore normal operation? ____
____

182. In event spoilers deploy in flight, proceed as follows: ____
____
____

183. During flight, with 1200 pounds external fuel remaining, drop tanks pressurized and transferring normally, and full internal fuel, the fuel transfer light comes ON steady and stays ON.

What malfunction is indicated? ____

At this point, how much fuel would you assume you have available? __________ pounds.

Would you actuate the emergency transfer system at this time? ____

Explain your decision. ____
____

184. List the restrictions applicable to flight with the EMER TRANS system activated.

Airspeed ________	Attitude ________	Other ________
Bank angle ________	Landings ________	________
Load Factor ________	Air refueling ________	________

185. If unable to obtain drop tank fuel by normal means, what action may be taken to obtain the fuel? __________
____
____.

A-4E/F NATOPS QUESTION BANK (Continued)

186. If you have a pitot-static system failure which is not rectified by selecting pitot heat, and you require pitot-static instruments to complete the flight, what can you do to restore operation? ____________

Will this restore normal operation? ____________

187. If the air refueling store drogue and coupling are lost, what must be done to feather the ram air turbine blades? ____________

188. What are the night light approach signals to a no-radio wingman? ____________

189. For an LPA, set the gunsight at ______ mils, place pipper ______ feet from the approach end of the runway to establish desired glide slope at ______ KIAS. Rate of descent will be ______ to ______ fpm depending on wind.

190. LPA checkpoints are established on the basis of ______ feet altitude for each ______ NMI from touchdown.

191. Which type of field arresting gear has the lowest maximum engaging speed limit (for all types of arrestments) ____________

192. Which type of field arresting gear has the lowest maximum off-center engagement limit? ____________

193. If you must land gear up on a foamed runway, what is the maximum desired fuel load? Why? ____________

194. Describe the emergency landing gear extension procedure:

195. In the event the landing gear does not indicate down and locked with the gear doors open, slowly increase airspeed up to a maximum of ______ KIAS to obtain a down and locked indication.

196. How is approach speed determined on a no-flap approach? ____________

197. Maximum recommended gross weight for a no-flap landing aboard ship is ______ pounds.

198. What angle-of-attack should be flown on landing approach with a stuck slat? ____________

199. With no airspeed or angle-of-attack, what can be used to indicate a safe approach speed? ____________

200. Describe procedure for landing with full NOSEDOWN trim:

201. If you know prior to landing that you have a blown main tire, what type of field landing would you plan to make? ____________

202. Procedures for a clean penetration are as follows: At penetration fix with 230 KIAS, lower nose to about ______ degrees nosedown. As airspeed reached ______ KIAS, extend speedbrakes. Maintain ______ KIAS and adjust power as necessary to maintain ______ to ______ fpm rate of descent. Initial power setting should be about ______ percent rpm.

203. The dirty penetration is performed at ______ KIAS, wheels and flaps DOWN, speedbrakes ______ and a rate of descent of ______ to ______ fpm. Power setting should be about ______ percent rpm.

A-4E/F NATOPS QUESTION BANK (Continued)

204. What is the approximate rate of descent for a GCA on a 3-degree glide slope with 5 knots of headwind?
____

205. On a section landing approach, when does the wingman obtain landing interval?
____

206. A section of aircraft is flying in instrument conditions when the wingman loses sight of the leader. He should:

a. ______________________________

b. Go on instruments, take ______ degree turn away from leader, hold for ______ minute then resume original heading.

207. The four basic steps of preparation for thunderstorm penetration are:

H ______________

A ______________

L ______________

T ______________

208. When utilizing the UHF transceiver, delay the transmission about 1 second after keying the mike to avoid
____

209. Minimum altitude for switching radio or IFF under night or IFR conditions is ______ feet.

210. Describe the visual hand signal used to indicate a question. ______________________________
____

211. What is the day signal that you are going to dump fuel? ______________________________

212. Describe the day signal to put your flight into cruising formation. ______________________________
____

213. A series of zooms is a signal to: ______________________________

214. Describe the signal used to ask bearing and distance to a TACAN station. ______________________________
____
____

215. Describe visual signal to wingman to have him turn his IFF to STANDBY.
____

216. Describe signal that your UHF transmitter has failed.

DAY ______________________________

NIGHT ______________________________

217. Describe signal to ready guns. ______________________________

218. The day HEFOE signal is arm bent across forehead as if weeping, followed by a numeral hand signal 1 to 5. What does each number stand for?

1. ______________________________

2. ______________________________

3. ______________________________

A-4E/F NATOPS QUESTION BANK (Continued)

218. (Continued)

4. ______________________________

5. ______________________________

219. As a no-radio wingman, you have been brought back to the field or ship and are configured for landing; your leader gives you a "thumbs-up" and points his finger toward the runway or ship with repeated stabbing motions. What does this signal mean? ______________________________

What action would you take? ______________________________

____

220. What is pilot's response to the pistol cocking signal from the arming supervisor? ______________________________

____

221. What signal should the ground crew use to indicate hot brakes? ______________________________

____

222. Why is it important that guns be SAFED in an authorized area? ______________________________

223. Maximum recommended crosswind component for landing is ______________________________. (A-4E)

224. The ESCAPAC I seat provides ground level escape capability at ________ KIAS with ________ rate of descent. (A-4E)

225. The ____________ switch must be moved from the ____________________ position for operation of the UHF remote channel indicator. (A-4E)

226. Minimum acceptable grades for the NATOPS written examinations are:

Open book ______________________________ Closed book ______________________________

PERFORMANCE DATA

1. Weight and Drag Computations

Given: Operating weight from Figure 11-1 as basic weight. In addition to items listed, the aircraft carries:

Full internal fuel JP-5 (pressure fueling).
200 rounds ammo.

Station 3: Full 300-gallon fuel tank.
Stations 1 and 5: AGM-12B missiles on Aero 5A-1 launchers.
Stations 2 and 4: 2 MK 82 LDGP (conical tails) on TER-7.

Find: Gross weight ____________________.
Total drag index ____________________.

2. Takeoff Speed – Operational

Given: Runway temperature: $90^{o}F$.
Runway pressure altitude: 500 feet.
Takeoff weight: 22,000 pounds.

Find: Takeoff speed – Operational ________ KCAS.

3. Takeoff distance – Operational, Line Speed Check, Takeoff Refusal Speed and Stopping Distance

Given: Data from Takeoff speed problem above.
Headwind: 6 knots.
Runway gradient: +1 percent.

A-4E/F NATOPS QUESTION BANK (Continued)

3. (Continued)

Find: Takeoff distance – Operational ________ feet.
Total distance to clear a 50-foot obstacle ________ feet.
Line speed check at the 2000-foot runway marker ________ KCAS.
Takeoff refusal speed for an 8500-foot runway ________ KIAS.
Stopping distance at takeoff refusal speed ________ feet.

4. Climb, Combat Ceiling and Optimum Cruise Altitude

Given: Initial gross weight: 21,000 pounds.
Cruise altitude: 27,000 feet.
Drag index: 100.
Temperature deviation: +5°C.

Find: Climb fuel ________ pounds.
Climb distance ________ nautical miles.
Climb time ________ minutes.

Given: Gross weight: 20,000 pounds.
Drag index: 100.

Find: Combat ceiling ________ feet.
Optimum cruise altitude ________ feet.

5. Fouled Deck Range

Given: Fuel on board: 1900 pounds.
Altitude: 20,000 feet.

Find: Chart is based on ________ drag index.
Reserve fuel allowance for landing ________ pounds.
Range at 20,000 feet ________ nautical miles.
Optimum altitude ________ feet.
Range at optimum altitude ________ nautical miles.
KCAS at optimum altitude ________ KCAS.
Climb schedule speed ________________________.
Descent speed ________ KCAS.
Start letdown from altitude with ________ pounds fuel remaining.

6. Long Range Cruise

Given: Average gross weight: 16,000 pounds.
Cruise altitude: optimum.
Drag index: 75.

Find: Optimum cruise altitude ________ feet.
EPR ________________.
Mach number ________.
Specific range ________ nautical miles/1000 pounds fuel.

7. Maximum Range Cruise

Given: Average gross weight: 16,000 pounds.
Pressure altitude: 35,000 feet.
Drag index: 75.
Outside air temperature: -50°C.
Wind: 50-knot headwind.
Ground distance: 400 nautical miles.

A-4E/F NATOPS QUESTION BANK (Continued)

7. (Continued)

Find: True Mach number ________.
Maximum range TAS ________ KTAS.
Time ________ minutes.
Specific range ________ nautical miles/1000 pounds fuel.
Fuel flow ________ pph.
Fuel required ________ pounds.

8. Nautical Miles Per Pound of Fuel

Given: Average gross weight: 18,000 pounds.
Cruise altitude: 15,000 feet.
Drag index: 150.
True Mach number: 0.59.
Outside air temperature: -20°C.

Find: Clean aircraft thrust required/δ amb ________ pounds.
Total thrust required/δ amb ________ pounds.
Nautical miles per pound of fuel ________.
True airspeed ________ KTAS.
Fuel flow ________ pph.
EPR ____________________.

9. Bingo Endurance

Given: Fuel on board: 1700 pounds.
Altitude: sea level.

Find: Chart is based on ________ drag index.
Reserve fuel allowance for landing ________ pounds.
Endurance at sea level ________ minutes.
Optimum altitude ________ feet.
Endurance at optimum altitude ________ minutes.
KCAS at optimum altitude ________ KCAS.
Climb schedule airspeeds ____
____
Descent speed ________ KCAS.
Start letdown from altitude with ________ pounds fuel remaining.

10. Maximum Endurance

Given: Average gross weight: 13,000 pounds.
Bank angle: 15 degrees.
Loiter altitude: optimum.
Drag index: 100.
Temperature deviation from standard day: +6°C.
Loiter time: 40 minutes.

Find: Optimum altitude ________ feet.
Optimum true Mach number ________.
Loiter airspeed ________ KCAS.
Fuel flow ________ pph.
Fuel required ________ pounds.

11. Tanker Fuel Available for Transfer

Given: Fuel: JP-5
Refueling radius: 20 nautical miles.

Find: Fuel available for transfer ________ pounds.

A-4E/F NATOPS QUESTION BANK (Continued)

3. (Continued)

Find: Takeoff distance – Operational ________ feet.
Total distance to clear a 50-foot obstacle ________ feet.
Line speed check at the 2000-foot runway marker ________ KCAS.
Takeoff refusal speed for an 8500-foot runway ________ KIAS.
Stopping distance at takeoff refusal speed ________ feet.

4. Climb, Combat Ceiling and Optimum Cruise Altitude

Given: Initial gross weight: 21,000 pounds.
Cruise altitude: 27,000 feet.
Drag index: 100.
Temperature deviation: +5°C.

Find: Climb fuel ________ pounds.
Climb distance ________ nautical miles.
Climb time ________ minutes.

Given: Gross weight: 20,000 pounds.
Drag index: 100.

Find: Combat ceiling ________ feet.
Optimum cruise altitude ________ feet.

5. Fouled Deck Range

Given: Fuel on board: 1900 pounds.
Altitude: 20,000 feet.

Find: Chart is based on ________ drag index.
Reserve fuel allowance for landing ________ pounds.
Range at 20,000 feet ________ nautical miles.
Optimum altitude ________ feet.
Range at optimum altitude ________ nautical miles.
KCAS at optimum altitude ________ KCAS.
Climb schedule speed ____________________ .
Descent speed ________ KCAS.
Start letdown from altitude with ________ pounds fuel remaining.

6. Long Range Cruise

Given: Average gross weight: 16,000 pounds.
Cruise altitude: optimum.
Drag index: 75.

Find: Optimum cruise altitude ________ feet.
EPR ____________ .
Mach number ________ .
Specific range ________ nautical miles/1000 pounds fuel.

7. Maximum Range Cruise

Given: Average gross weight: 16,000 pounds.
Pressure altitude: 35,000 feet.
Drag index: 75.
Outside air temperature: -50°C.
Wind: 50-knot headwind.
Ground distance: 400 nautical miles.

A-4E/F NATOPS QUESTION BANK (Continued)

7. (Continued)

Find: True Mach number ________.
Maximum range TAS ________ KTAS.
Time ________ minutes.
Specific range ________ nautical miles/pound fuel.
Fuel flow ________ pph.
Fuel required ________ pounds.

8. Nautical Miles Per Pound of Fuel

Given: Average gross weight: 18,000 pounds.
Cruise altitude: 15,000 feet.
Drag index: 150.
True Mach number: 0.59.
Outside air temperature: -20°C.

Find: Clean aircraft thrust required/δ amb ________ pounds.
Total thrust required/δ amb ________ pounds.
Nautical miles per pound of fuel ________.
True airspeed ________ KTAS.
Fuel flow ________ pph.
EPR ____________________.

9. Bingo Endurance

Given: Fuel on board: 1700 pounds.
Altitude: sea level.

Find: Chart is based on ________ drag index.
Reserve fuel allowance for landing ________ pounds.
Endurance at sea level ________ minutes.
Optimum altitude ________ feet.
Endurance at optimum altitude ________ minutes.
KCAS at optimum altitude ________ KCAS.
Climb schedule airspeeds ____

____

Descent speed ________ KCAS.
Start letdown from altitude with ________ pounds fuel remaining.

10. Maximum Endurance

Given: Average gross weight: 13,000 pounds.
Bank angle: 15 degrees.
Loiter altitude: optimum.
Drag index: 100.
Temperature deviation from standard day: +6°C.
Loiter time: 40 minutes.

Find: Optimum altitude ________ feet.
Optimum true Mach number ________.
Loiter airspeed ________ KCAS.
Fuel flow ________ pph.
Fuel required ________ pounds.

11. Tanker Fuel Available for Transfer

Given: Fuel: JP-5
Refueling radius: 20 nautical miles.

Find: Fuel available for transfer ________ pounds.

A-4E/F NATOPS QUESTION BANK (Continued)

11. (Continued)

Tanker Fuel Transfer Time

Given: Fuel: JP-5
Fuel transferred to receiver: 5500 pounds.

Find: Elapsed time ________ minutes.
Point where fueling temporarily discontinued ________ minutes.
Point where fueling resumed ________ minutes.

12. Fuel Consumption of Tanker During Air Refueling

Given: Refueling speed: 230 KCAS.
Gross weight: 22, 000 pounds.

Find: Fuel flow at 30, 000 feet ________ pph.
Fuel flow at 20, 000 feet ________ pph.

13. Descent

Given: Initial gross weight: 13, 000 pounds.
Cruise altitude: 40, 000 feet.
Drag index. 100.

Find: Fuel required ________ pounds.
Distance ________ nautical miles.
Descent speed ________ KCAS.
Time ________ minutes.

14. Approach Speed

Given: Gear: down.
Speedbrakes: open.
Thrust required to maintain 4-degree slide slope.
Optimum approach AOA.

Find: Indicated airspeeds as follows:

SPEED	FLAPS	GROSS WEIGHT – POUNDS			
		12, 000	13, 000	14, 000	16, 000
Stall speed	Flaps up				
	Full flaps				
Approach speed	Flaps up				
	Full flaps				

15. Landing Distance

Given: Air temperature: 40°F.
Pressure altitude: 4000 feet.
Gross weight: 14, 000 pounds.
Flap deflection: Full.
Headwind: 10 knots.
Runway gradient: 0.

A-4E/F NATOPS QUESTION BANK (Continued)

15. (Continued)

Find: Ground roll distance – dry runway________feet.
Total distance to clear a 50-foot obstacle with 4-degree glide slope for dry runway________feet.
Ground roll distance – wet runway________feet.
Ground roll distance – snow and ice________feet.

16. Turning Radius

Given: True airspeed: 350 KTAS.
Bank angle: 45 degrees.
Heading change: 90 degrees.

Find: Turning radius________feet.
Distance traveled in turn ________nautical miles.

17. Maneuverability

Given: Gross weight: 20,000 pounds.
Mach number: 0.65.
Altitude: sea level.
Drag index: 100.

Find: Normal load factor x gross weight ________pounds.
Normal load factor________g.

18. Maximum Mach number

Given: Drag index: 72.
Gross weight: 18,000 pounds.

Find: Maximum true Mach number – lea level ________.
Maximum true Mach number – 10,000 feet________.

19. Military Fuel Flow

Given: Pressure altitude: 16,000 feet.
Mach number: 0.8.

Find: Fuel flow________pounds/minute.
Fuel flow________pounds/hour.

TRUE OR FALSE

1. The manual fuel control light should never be on while the fuel control switch is in the PRIMARY position.
2. High rates of roll can cause momentary erroneous EGT indications.
3. Fuel flow rates less than 300 pounds per hour may be interpolated on the indicator dial.
4. The IDLE EGT limit of 340°C is not a firm operating limit.
5. Oil pressure indications are not available on emergency generator.
6. Oil quantity indicator/switch indications should be valid during taxi.
7. When utilizing emergency transfer, fuel is transferred to the fuselage tank through the pressure fueling line only.
8. The emergency wing tank fuel transfer system will not operate on emergency generator.

A-4E/F NATOPS QUESTION BANK (Continued)

9. Transfer of external fuel may not be possible with the wing fuel switch in the EMER TRANS position.
10. Operating the wing fuel switch to the DUMP position while the drop tanks are pressurized may over-pressurize the wing fuel cell.
11. Drop tank fuel transfer is not available on emergency generator.
12. The fuel boost warning light normally comes on when the wing fuel cell is depleted.
13. The armament safety disable switch is a momentary switch and enables power to energize the armament bus only while it is held closed.
14. Hydraulic systems will operate with engine windmilling.
15. With a flight control hydraulic system failure, dropping the landing gear will cause a temporary decrease in the effectiveness of the flight controls.
16. Ailerons may be trimmed with the followup tab when on emergency generator.
17. Loss of rudder hydraulic power will result in loss of rudder trim.
18. Pulling the manual flight control T-handle disconnects the elevator, aileron, and rudder power cylinders from the flight controls.
19. Normal trim is available after a hydraulic power disconnect.
20. Speedbrakes are not available on emergency generator.
21. Wheelbrakes utilize utility system pressure.
22. It is possible to receive erroneous indications on the gyro indicator without OFF flag showing.
23. Turn needle on AJB-3/3A is still reliable when OFF flag appears on gyro indicator.
24. The turn needle will operate on emergency generator power.
25. A/A mode of the TACAN provides range and bearing information on a cooperating aircraft.
26. Excessive UHF-ADF bearing errors may result when stores are carried on centerline station.
27. The detail control has no effect when the radar is in SEARCH mode.
28. The AFCS will not operate on emergency generator.
29. With both hydraulic systems normal the AFCS will operate after the manual flight control disconnect handle is pulled.
30. The AFCS will continue to operate if only the utility hydraulic system fails.
31. The AFCS can be utilized in all modes with the aileron trim switch in the EMER position.
32. The AFCS should be placed in STBY for takeoff.
33. The control stick trim switch is inoperative whenever the AFCS is engaged.
34. Depressing the PUSH TO SYNC button on the compass controller will disengage the AFCS.
35. The rain removal system is available on emergency generator.
36. The rain repellent system is inoperative during emergency generator operation.
37. A utility hydraulic system failure has no effect on JATO system operation.
38. The thermal radiation enclosure must be open prior to attempting an ejection.

A-4E/F NATOPS QUESTION BANK (Continued)

39. Drop tanks cannot be pressure fueled if electrical power is not available.

40. External electrical power should be connected to the aircraft for gravity fueling.

41. Failure of the J52-P-8A engine fuel control to maintain EGT within limits at all altitudes is a "downing" discrepancy.

42. Low air pressure in the canopy air bungee cylinder will jeopardize canopy jettison capability.

43. Aircraft may be taxied with the canopy partially open if the canopy control handle is placed in the closed position and relative wind does not exceed 60 knots.

44. If directional control difficulties are encountered during takeoff, nosewheel steering may be safely engaged at speeds up to 70 knots. (A4-F)

45. Spoilers should be used when taxiing in a crosswind on the flight deck aboard ship.

46. When a tillerbar is used, nosewheel steering should be used judiciously. (A4-F)

47. If the aircraft goes down on the catapult, give the catapult officer a thumbs-down signal.

48. EPR readings are not valid on catapult launches because of the wind-over-the-deck.

49. The aircraft may be hot-refueled through the probe or the pressure fueling receptacle.

50. The pilot will close and lock the canopy and select ram air during hot-refueling.

51. Raising the wing flaps or landing gear causes a nosedown trim change.

52. The AFCS is equipped with automatic pitch trim.

53. Receiver must ensure that the EMERGENCY WING TANK TRANSFER switch is OFF before engaging in air refueling.

54. After the HOSE JETTISON switch is actuated, it should be returned to the OFF position.

55. The air refueling store turbine should not be energized after fuel is dumped from the store.

56. Placing the SHIP-TANK switch in the TO STORE position imposes the same restrictions on the aircraft as placing the EMERGENCY WING TANK TRANSFER switch to EMER TRANS.

57. Restrictions listed with SHIP-TANK switch in the TO STORE position do not apply unless a refueling store is actually carried.

58. Brakes should be pumped for maximum effectiveness on a minimum distance landing.

59. If the retraction safety-solenoid is inoperative after takeoff, actuate the retraction-release switch manually, raise the gear. and continue the mission.

60. With a throttle linkage failure the engine will stabilize at 85 to 87 percent rpm.

61. Negative-g flight is recommended prior to lightoff on an airstart, to clear the engine of residual fuel.

62. With a wing fire in flight, you should jettison your drop tanks even though transfer has been completed.

63. In the event of electrical fire on normal generator, placing the emergency generator bypass switch to BYPASS will eliminate normal generator electrical power to the aircraft.

64. When a water landing is imminent, disconnect the parachute-riser releases just prior to water contact.

65. After flight control disconnect on a test hop, you can utilize the AFCS.

66. With a complete hydraulic failure and the flight control system disconnected, high rudder forces should be expected because the tandem rudder actuator does not disconnect.

A-4E/F NATOPS QUESTION BANK (Continued)

67. If aileron trim fails, you should attempt to check the trim circuit by operating the trim switch in the opposite direction.

68. If aileron trim runs to maximum deflection before it can be stopped, disconnect the flight control system.

69. Air refueling store hose jettison is available on emergency generator.

70. Fuel cannot be transferred from the air refueling store to the wing when on emergency generator.

71. For a carrier barricade engagement with a landing gear malfunction, the cross deck pendants should be left on deck.

72. In an underwater escape situation, if the canopy cannot be jettisoned, the service revolver should be used to crack out the plexiglass.

73. In an underwater escape situation, inflating the MK-3C while in the cockpit will aid in escape by floating the pilot out of the cockpit.

74. Use of the rain removal system is recommended to remove ice from the windshield.

75. The air conditioning system contains a water separator.

76. If gun charging switch is inadvertently switched to SAFE after your first practice live strafing run, you can switch back to READY and continue making firing runs if guns fired normally on the first pass.

77. External stores cannot be jettisoned by the emergency release system if the landing gear are down.

78. A pilot who achieves a grade of conditionally qualified on a NATOPS evaluation may not fly without a qualified chase pilot.

79. The NATOPS Ground Evaluation must be satisfactorily completed prior to the Flight Evaluation.

80. When the FUEL TRANS BYPASS switch is in FUS ONLY, no fuel is transferred to or from the wing tanks. (A-4E)

81. Both the APX-6B (IFF) and the APA-89 (SIF) will operate on emergency generator power. (A4-E)

82. The ejection seat face curtain handle adjusts automatically during seat position adjustment. (A4-E)

83. In the J52-P-6A engine, ground starting ignition is supplied by the 4-joule system. (A4-E)

MULTIPLE CHOICE

1. Horizontal stabilizer trim limits are:

   a. 12 degrees noseup, 1 degree nosedown
   b. 11 degrees noseup, 1 1/2 degrees nosedown
   c. 12 1/4 degrees noseup, 1 1/4 degrees nosedown
   d. 12 1/4 degrees noseup, 1 degree nosedown.

2. When the master light switch is ON, the approach lights will be:

   a. Unaffected
   b. Dimmed
   c. Bright
   d. Flashing.

A-4E/F NATOPS QUESTION BANK (Continued)

3. On emergency generator:

   a. Only exterior lights are available.
   b. Exterior and interior lights are available.
   c. Probe light is available.
   d. Approach lights are available.

4. With a full air refueling store and two full drop tanks, placing the air refueling store SHIP-TANK switch in the FROM STORE position and the drop tank transfer switch in OFF, external fuel will:

   a. Not transfer.
   b. Transfer from air refueling store only.
   c. Transfer from air refueling store and drop tanks.
   d. Transfer from drop tanks only.

5. The rpm at MILITARY thrust:

   a. Does not vary with changes in inlet temperature.
   b. Decreases as inlet temperature decreases.
   c. Increases as inlet temperature decreases.
   d. None of the above.

6. When P/C holds his fist vertically in front of himself and makes a large horizontal circle with his fist, proper pilot response is:

   a. Move all controls through full travel checking for proper throw and feel.
   b. Ascertain no hydraulic ladder lights come on when flight controls are moved rapidly.
   c. Position flight controls to full left rudder, stick full aft and port.
   d. All of the above.

7. If refueling master switch is placed in OFF position with a receiver aircraft plugged in and receiving fuel, the following will result.

   a. Fuel transfer will stop.
   b. Fuel transfer will stop and hose will retract.
   c. Air turbine will feather.
   d. None of the above.

8. Which of the following will stop fuel transfer to a receiver aircraft?

   a. Turning SHIP-TANK switch OFF.
   b. Placing refueling master switch OFF.
   c. Turning fuel transfer switch OFF.
   d. All of the above.

SECTION XI
PERFORMANCE DATA

TABLE OF CONTENTS

INTRODUCTION

The operating data charts in this section provide the pilot with information enabling him to realize the maximum performance capabilities of the aircraft. Use of the chart material for preflight planning and application of the prescribed operating procedures will result in optimum effectiveness of the aircraft.

Section XI is divided into 18 parts to present performance data in proper sequence for preflight planning. Part 1 (General) and part 10 (Mission Planning) contain data pertinent to the complete section. Parts 2 through 9 present information and material pertinent only to the J52-P-8A engine. The A-4E aircraft may have either the J52-P-8A or J52-P-6A engine installed. All A-4F charts are applicable to A-4E aircraft with the J52-P-8A engine installed. Parts 2A through 9A present information peculiar to the J52-P-6A engine. Sample problems and charts are provided (in parts 1 through 10 only) to present the sequence of steps required to find the proper values and solution of a given problem. Performance data is presented in graphical type charts for ICAO standard day conditions. In some instances, temperature corrections for nonstandard atmosphere have been included.

PART 1
GENERAL

Performance Data Basis

Performance data is based on aircraft characteristics obtained from A-4E/F Navy and TA-4F Contractor flight tests, calculations, and engine data from Pratt and Whitney specifications. All charts are presented for ICAO standard atmosphere conditions, although ambient temperature correction scales are provided in a number of charts where temperature effects are significant. All performance is based on a center of gravity position of 25 percent MAC. All charts are applicable to JP-4 or JP-5 fuel, having a nominal density of 6.5 and 6.8 pounds per gallon respectively.

Abbreviations, Symbols, and Definitions

Abbreviation	Definition
a/a_o	Ratio of speed of sound at altitude to speed of sound at sea level, ICAO standard day
ac	Alternating current
ADF	Automatic direction finding
Alt	Altitude
^oC	Degrees Centigrade
CAS or V_c	Calibrated airspeed = IAS corrected for position error
CG	Center of gravity
dc	Direct current
Deg	Degree
Amb	Free stream static condition
EAS or V_e	Equivalent airspeed = CAS corrected for compressibility effect
EGT	Exhaust gas temperature
EPR	Engine pressure ratio

Abbreviation	Definition
^oF	Degrees Fahrenheit
Flt	Flight
FPM or fpm	Feet per minute
Freq	Frequency
Ft or ft	Feet
g	Gravity force
H or h	Altitude
Hg	Mercury
hr	Hour
IAS or V_i	Indicated airspeed = instrument reading corrected for instrument error
ICAO	International Civil Aviation Organization
In	Inches
KCAS	Knots calibrated airspeed
KEAS	Knots equivalent airspeed
KIAS	Knots indicated airspeed
KTAS	Knots true airspeed
Kts/Kn	Knots
lb	Pounds
M	Mach number
MAX	Maximum
min	Minutes
mm	Millimeters
n	Normal load factor
NM or NMi	Nautical Miles
OAT	Outside air temperature

Abbreviation	Definition
P	Static atmospheric pressure at any altitude
P_o	Static atmospheric pressure at sea level ICAO standard day = 29.92 inches of mercury
psi	Pounds per square inch
RCR	Runway condition reading
RPM	Revolutions per minute (Engine speed)
SL	Sea level
Std	Standard
T	Static absolute temperature at any altitude
T_o	Static absolute temperature at sea level ICAO standard day = 288.2 degrees Kelvin
TAS	True airspeed
Vol	Volume
Wt	Weight
Δ	Delta – change in (e.g. gross weight)
δ or P/P_o	Delta – ratio of static air pressure to ICAO standard sea level static air pressure
μ	Coefficient of rolling friction
ρ	Rho – density of atmosphere in slugs per foot at any altitude
ρ_o	Rho – density of atmosphere at sea level ICAO standard day = 0.002378 slugs per foot
σ or ρ/ρ_o	Sigma – ratio of density at any altitude to density at sea level, ICAO standard day
θ or T/T_o	Theta – ratio of absolute temperature of any altitude to absolute temperature at sea level; ICAO standard day

Drag Count Index System

The large variety of possible external store loadings permitted on the A-4E/F requires revised methods of performance data presentation. This method, called the Drag Count Index System, permits the presentation of performance data for a number of external store loadings on one chart, greatly reducing the number of charts required.

In the Drag Count Index System, each item of the external store configuration, such as a bomb, tank, pylon or multiple bomb adapter, is assigned a drag number whose value depends on the size and shape of the item and its location on the aircraft. The summation of these individual drag numbers, for a particular loading, defines the drag index for that configuration. This index, when applied to the performance charts, defines the performance of that configuration.

Some of the individual store drag numbers used for determining the drag indexes are shown in figure 11-1, and a complete listing is made in NAVAIR 01-40AV-1T. Note that the drag numbers for a given store, depend on the store station on which they are carried. The weights of typical external stores, pylons, tanks, and adapters are included in figure 11-1. The drag of the clean aircraft includes the drag of the centerline pylon and upper avionics pod but no guns or wing pylons.

SAMPLE PROBLEM

Drag Indexes

(For figure 11-1)

Assume the external configuration consists of a 300-gallon Aero 1-D fuel tank on the centerline pylon, a 6x300-pound MK 81 Snakeye bomb cluster on each inboard wing pylon, and a 500-pound MK 82 bomb on each outboard wing pylon.

External Store Item	Drag Index	Weight-Pounds
Clean aircraft (A-4F)	7.0	——
2 MK 12 20mm guns and ammunition	7.0	457
1 300-gallon Aero-1D fuel tank on centerline (full)	15.0	2223
2 inboard wing pylons	12.0	140
2 outboard wing pylons	14.0	128

NEW

External Store Item	Drag Index	Weight-Pounds
2 MER-7 multiple bomb adapters	46.0	446
2 6x300-pound MK 81 Snakeye bombs	82.0	3600
2 500-pound MK 82 bombs	12.0	1130
Totals	195.0	8124

As the mission is flown, tanks may be dropped and stores will be expended changing the external store configuration and thus the drag index.

1. After the centerline fuel tank is dropped:

External Store Item	Drag Index
Clean aircraft	
A-4F	7.0
A-4E	0.0
With upper avionics pod	
A-4E	9.0
2 MK 12 20mm guns	7.0
2 inboard wing pylons	12.0
2 outboard wing pylons	14.0
2 MER-7 multiple bomb adapters	46.0
2 6x300-pound MK 81 Snakeye bombs	82.0
2 500-pound MK 82 bombs	12.0
Total drag index	A-4F 180.0 A-4E 173.0 *A-4E 182.0

2. After the centerline fuel tank is dropped and the bombs are expended:

External Store Item	Drag Index
Clean aircraft	
A-4F	7.0
A-4E	0.0
With upper avionics pod	
A-4E	9.0
2 MK 12 20mm guns	7.0
2 inboard wing pylons	12.0
2 outboard wing pylons	14.0
2 MER-7 multiple bomb adapters	46.0
Total drag index	A-4F 86.0 A-4E 79.0 *A-4E 88.0

*A-4E with upper avionics pod

Airspeed Corrections

Several corrections to the airspeed indicator reading must be added to arrive at the true airspeed of the aircraft. Two corrections peculiar to the indicator itself are instrument error and lag. These errors, which are usually insignificant, are added algebraically to the indicator reading to obtain the indicated airspeed.

Calibrated airspeed is equal to the airspeed indicator reading corrected for position and instrument error. Position error, shown in figures 11-6 and 11-7, is an error introduced due to the location of the static source at a point of nonambient static pressure.

Equivalent airspeed is equal to the airspeed indicator reading corrected for position error, instrument error, and for adiabatic compressible flow, compressibility correction, for the particular altitude.

True airspeed is related to equivalent airspeed by the following: KTAS = KEAS X $1/\sqrt{\sigma}$

To convert calibrated airspeed to true airspeed and true Mach number, figure 11-2 is provided. Figure 11-2 has compressibility effects built into the graph permitting a direct step from calibrated to true airspeed.

A position error is associated with the Mach number indicated values and the true Mach number values. This relationship is shown in figures 11-6 and 11-8.

SAMPLE PROBLEM

Airspeed Correction for Position Error

(For figure 11-6)

(A) Indicated airspeed . . . . 350 kn

(B) Pressure altitude . . . . 20,000 ft

(C) ΔV-correction to be added . . . . +2.6 kn

Calibrated airspeed . . . . 352.6 kn

Mach Number Correction for Position Error

(For figure 11-7)

(D) Indicated Mach number . . . . 0.741 M

(E) ΔM-correction to be added . . . . +0.006

True Mach number . . . . 0.747 M

Airspeed Conversion

(For figure 11-2)

(A) Calibrated airspeed . . . . 360 kn

(B) True pressure altitude . . . . 25,000 ft

(C) True Mach number . . . . 0.85 M

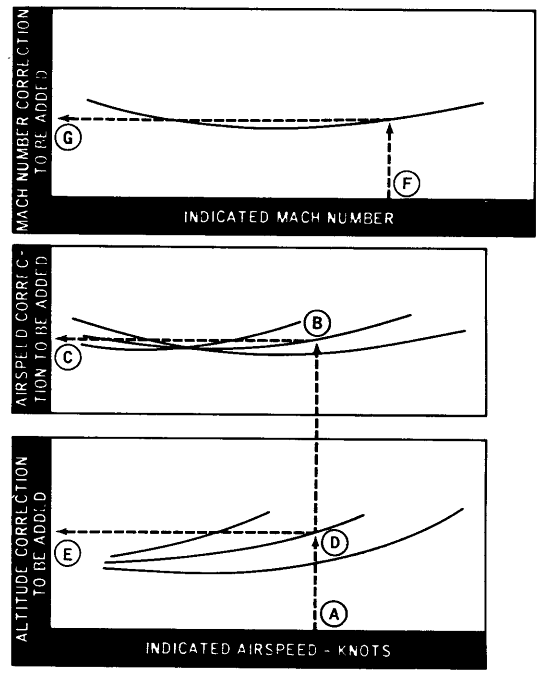
(D) OAT . . . . 20°C

(E) True airspeed . . . . 569 kn

Altimeter Corrections

The altimeter is connected to the static source. Position error corrections, similar to those for airspeed indications, must be applied to the altimeter indications to obtain true pressure altitude. The corrections are given in figure 11-6 and 11-7. Instrument error and altimeter lag are also prevalent in the altimeter system. The lag error (approximately 200 feet) could be significant in a low altitude dive pullout.

SAMPLE AIRSPEED ALTITUDE AND MACH NUMBER CORRECTION FOR POSITION ERROR (A-4F)



GG1-78

SAMPLE PROBLEM

Altitude Correction for Position Error

(For figure 11-6)

(A) Indicated airspeed . . . . 350 kn

(D) Pressure altitude . . . . 20,000 ft

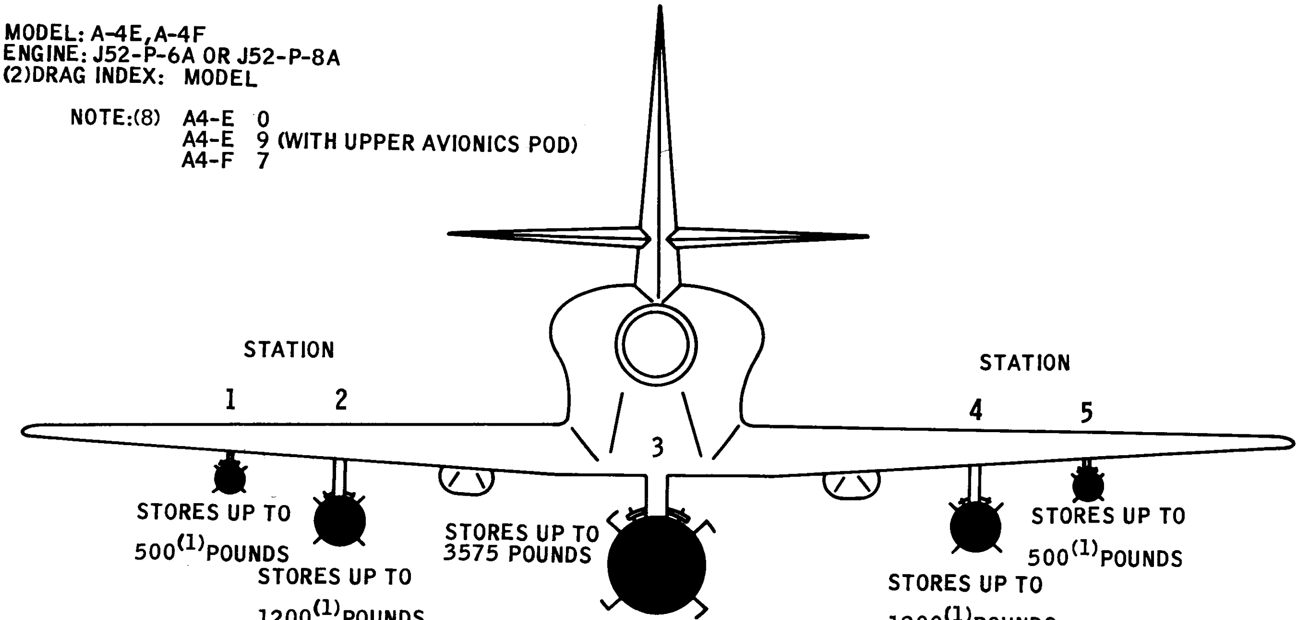
(E) Δh – correction to be added . . . . +185 ft

True pressure altitude . . . . 20,185 ft

STORE DRAG INDEXES AND GROSS WEIGHTS

MODEL: A-4E, A-4F
ENGINE: J52-P-6A OR J52-P-8A
(2)DRAG INDEX: MODEL

NOTE:(8) A4-E 0
A4-E 9 (WITH UPPER AVIONICS POD)
A4-F 7



AIRCRAFT WEIGHT (POUNDS)			
TYPICAL WEIGHTS EMPTY	A4-E	A4-E	A4-F
OPERATING WEIGHT (3)	10,266 (4)(6)(7)	10,802 (5)(6)(7)	10,933 (5)
TWO 20MM GUNS (NO AMMO)	314	314	314
TWO AERO 20A RACK-PYLONS ON STATIONS 75 (2 AND 4)	140	140	140
TWO AERO 20A RACK-PYLONS ON STATION 113.75 (1 AND 5)	128	128	128
TWO 300-GALLON AERO-1D EXTERNAL FUEL TANKS	*398	*398	*398
ARMOR PLATE	97	97	97
TOTAL OPERATING WEIGHT	11,343	11,879	12,010

*CHANGED BY NAVAIRSYSCOM LETTER DATED 10 APRIL 1969.

NOTES:

1. REFER TO A-4/TA-4 TACTICAL MANUAL NAVAIR 01-40AV-1T FOR CARRIAGE AND RELEASE LIMITATIONS, AND EXCEPTIONS FOR CARRIAGE OF CERTAIN STORES WEIGHING MORE THAN STATION LIMITATIONS SHOWN.
2. CLEAN AIRCRAFT CONFIGURATION (LESS GUNS AND WING PYLONS).
3. OPERATING WEIGHT INCLUDES A CENTERLINE AERO 7A RACK (WITH FAIRING), CREW, ENGINE OIL, TRAPPED FUEL AND OIL, LIQUID OXYGEN (10 LITER), AND MISCELLANEOUS EQUIPMENT (PARAKITS, ETC.).
4. OPERATING WEIGHT DOES NOT INCLUDE ECM EQUIPMENT.
5. OPERATING WEIGHT INCLUDES UPPER AVIONICS POD AND ECM EQUIPMENT INSTALLED.
6. WITH J52-P-6A ENGINE. INCREASE WEIGHT 76 POUNDS USING J52-P-8A ENGINE.
7. WITH WING SPOILERS ADD 32 POUNDS.
8. FOR MODEL A-4E WITH WING SPOILERS ADD 1 DRAG INDEX.

GG1-12-B

Figure 11-1. Drag Indexes (Sheet1)

Guns and Suspension Equipment	Approx Weight lb/ea	Drag Index at Store Station				
		1	2	3	4	5
Two MK 12 Guns and 200 Rounds Ammo	457			7		
One AERO 20A Rack-Pylon	68		6		6	
One AERO 20A Rack-Pylon	64	7				7
*AERO 5A-1 Launcher	99	7	7	7	7	7
A/A 37B-1 MBR	159	14	14	14	14	14
A/A 37B-3 PMBR	87					
*TER-7	105		13	13	13	
*MER-7	223		25	25	25	

*Changed by NAVAIRSYSCOM letter dated 10 April 1969.

Tanks and Pods(1)	SUSPENSION	No. of Stores	Approx Weight lb/ea	Drag Index at Store Station				
				1	2	3	4	5
150-GAL Fuel Tank; FULL/EMPTY(2)	AERO 20A, -7A	1	*1156/136		10	10	10	
300-GAL Fuel Tank (Bobtail); FULL/EMPTY(2)	AERO-7A	1	2223/183			15		
300-GAL Fuel Tank (4 Fins); FULL/EMPTY(2)	AERO-20A	1	*2239/199		14		14	
400-GAL Fuel Tank; FULL/EMPTY(2)	AERO-7A	1	2960/240			20		
300-GAL Refueling Store; FULL/EMPTY(2)	AERO-7A	1	2740/719			30/119(3)		
GTC-85 Pod-Mounted; FULL/EMPTY	AERO-20A, -7A	1	700/650		19	21	19	

*Changed by NAVAIRSYSCOM letter dated 10 April 1969.

NOTES:
1. Refer to the NAVAIR 01-40AV-1T, A-4/TA-4 Tactical Manual for all other applicable external store drag index and weight data, carriage and release limitations, and exceptions for carriage of the stores weighing more than station limitations noted on sheet 1.
2. Fuel tank weight for JP-5 fuel.
3. Hose and drogue: retracted/extended.

Figure 11-1. Drag Indexes (Sheet 2)

AIRSPEED CONVERSION

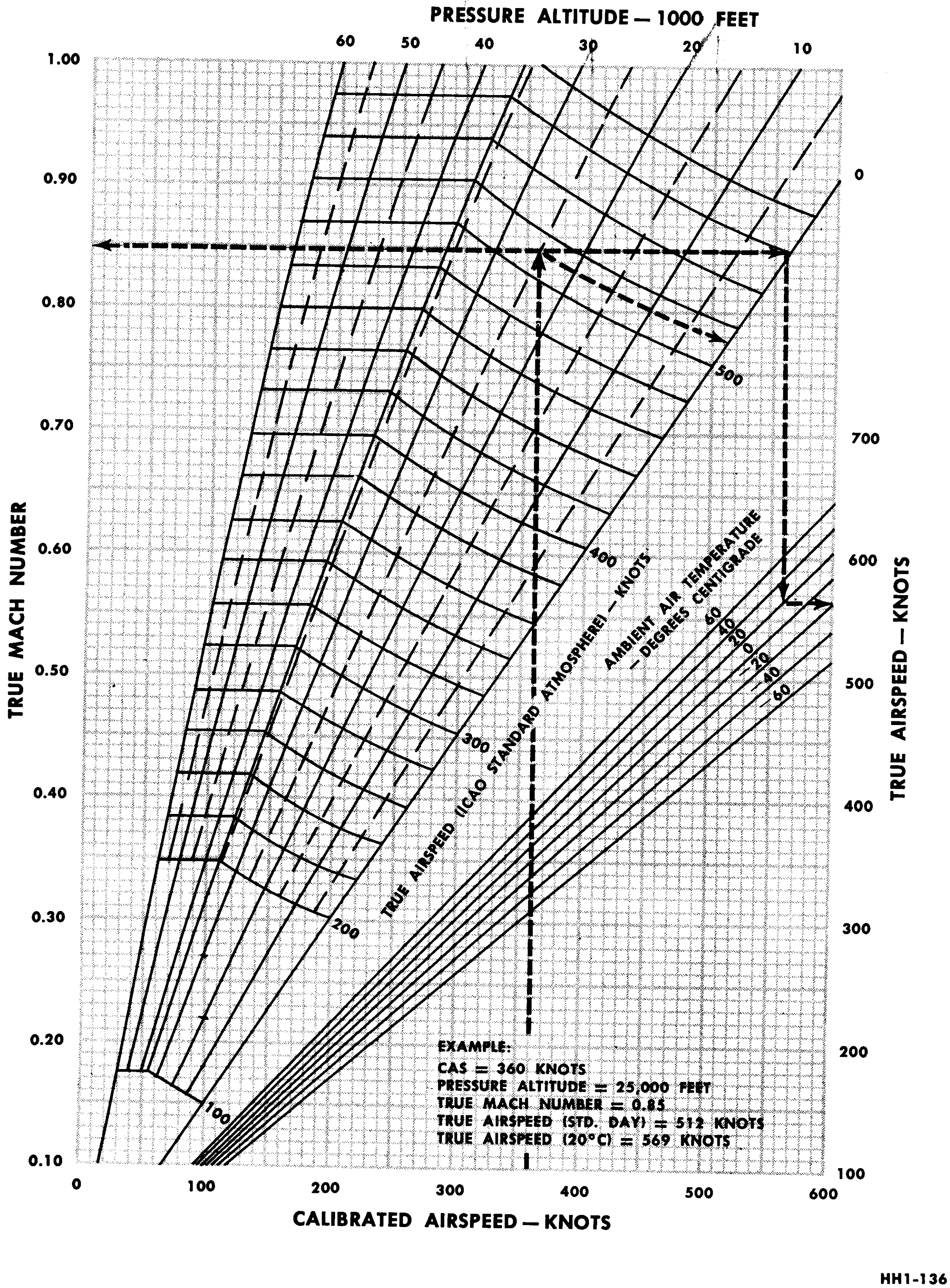


Figure 11-2. Airspeed Conversion

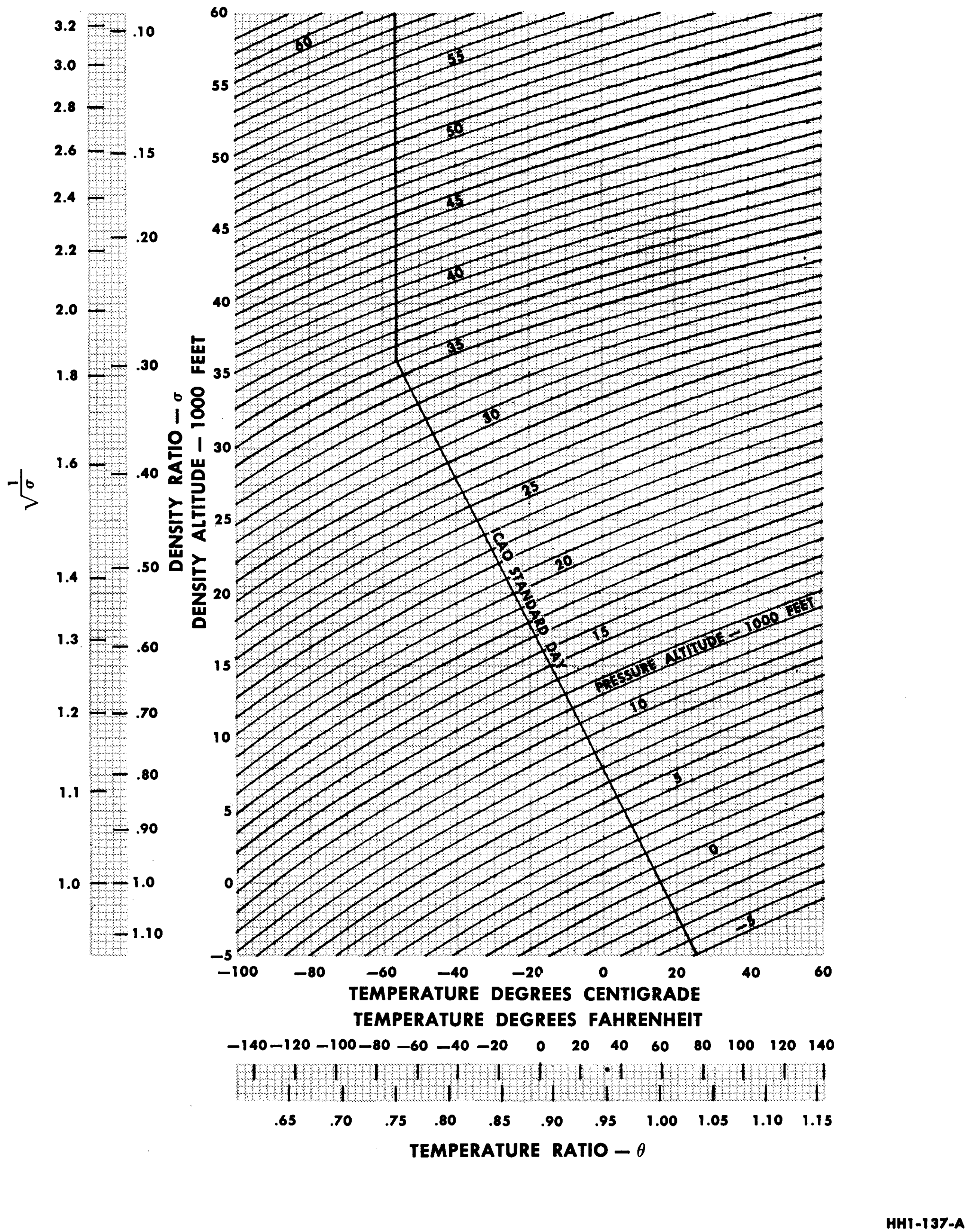


Figure 11-3. Density Altitude Chart

Degrees Centigrade	Degrees Fahrenheit	Degrees Centigrade	Degrees Fahrenheit	Degrees Centigrade	Degrees Fahrenheit
-75	-103.0	-33	-27.4	9	48.2
-74	-101.2	-33	-25.6	10	50.0
-73	- 99.4	-31	-23.8	11	51.8
-72	- 97.6	-30	-22.0	12	53.6
-71	- 95.8	-29	-20.2	13	55.4
-70	- 94.0	-28	-18.4	14	57.2
-69	- 92.2	-27	-16.6	15	59.0
-68	- 90.4	-26	-14.8	16	60.8
-67	- 88.6	-25	-13.0	17	62.6
-66	- 86.8	-24	-11.2	18	64.4
-65	- 85.0	-23	- 9.4	19	66.2
-64	- 83.2	-22	- 7.6	20	68.0
-63	- 81.4	-21	- 5.8	21	69.8
-62	- 79.6	-20	- 4.0	22	71.6
-61	- 77.8	-19	- 2.2	23	73.4
-60	- 76.0	-18	0.4	24	75.2
-59	- 74.2	-17	1.4	25	77.0
-58	- 72.4	-16	3.2	26	78.8
-57	- 70.6	-15	5.0	27	80.6
-56	- 68.8	-14	6.8	28	82.4
-55	- 67.0	-13	8.6	29	84.2
-54	- 65.2	-12	10.4	30	86.0
-53	- 63.4	-11	12.2	31	87.8
-52	- 61.6	-10	14.0	32	89.6
-51	- 59.8	- 9	15.8	33	91.4
-50	- 58.0	- 8	17.6	34	93.2
-49	- 56.2	- 7	19.4	35	95.0
-48	- 54.4	- 6	21.2	36	96.8
-47	- 52.6	- 5	23.0	37	98.6
-46	- 50.8	- 4	24.8	38	100.4
-45	- 49.0	- 3	26.6	39	102.2
-44	- 47.2	- 2	28.4	40	104.0
-43	- 45.4	- 1	30.2	41	105.8
-42	- 43.6	0	32.0	42	107.6
-41	- 41.8	1	33.8	43	109.4
-40	- 40.0	2	35.6	44	111.2
-39	- 38.2	3	37.4	45	113.0
-38	- 36.4	4	39.2	46	114.8
-37	- 34.6	5	41.0	47	116.6
-36	- 32.8	6	42.8	48	118.4
-35	- 31.0	7	44.6	49	120.2
-34	- 29.2	8	46.4	50	122.0

Figure 11-4. Centigrade/Fahrenheit Conversion

Altitude Feet	Density Ratio $\sigma = \rho/\rho o$	$\frac{1}{\sqrt{\sigma}}$	Temperature ^oC	Temperature ^oF	Temperature Ratio $\theta = T/T_o$	Speed of Sound Ratio a/ao	Pressure In. of Hg	Pressure Ratio $\delta = P/P_o$
Sea Level	1.0000	1.0000	15.000	59.000	1.0000	1.000	29.921	1.0000
1000	0.9711	1.0148	13.019	55.434	0.9931	0.997	28.856	0.9644
2000	0.9428	1.0299	11.038	51.868	0.9862	0.993	27.821	0.9298
3000	0.9151	1.0454	9.056	48.302	0.9794	0.990	26.817	0.8962
4000	0.8881	1.0611	7.075	44.735	0.9725	0.966	25.842	0.8637
5000	0.8617	1.0773	5.094	41.169	0.9656	0.983	24.896	0.8320
6000	0.8359	1.0938	3.113	37.603	0.9587	0.979	23.978	0.8014
7000	0.8106	1.1107	1.132	34.037	0,9519	0.976	23.088	0.7716
8000	0.7860	1.1279	-0.850	30.471	0.9450	0.972	22.225	0.7428
9000	0.7620	1.1456	-2.831	26.905	0.9381	0.969	21.388	0.7148
10,000	0.7385	1.1637	-4.812	23.338	0.9312	0.965	20.577	0.6877
11,000	0.7156	1.1822	-6.793	19.772	0.9244	0.961	19.791	0.6614
12,000	0.6932	1.2011	-8.774	16.206	0.9175	0.958	19.029	0.6360
13,000	0.6713	1.2205	-10.756	12.640	0.9106	0.954	18.292	0.6113
14,000	0.6500	1.2403	-12.737	9.074	0.9037	0.951	17.577	0.5875
15,000	0.6292	1.2606	-14.718	5.508	0.8969	0.947	16.886	0.5643
16,000	0.6090	1.2815	-16.699	1.941	0.8900	0.943	16.216	0.5420
17,000	0.5892	1.3028	-18.680	-1.625	0.8831	0.940	15.569	0.5203
18,000	0.5699	1.3246	-20.662	-5.191	0.8762	0.936	14.942	0.4994
19,000	0.5511	1.3470	-22.643	-8.757	0.8694	0.932	14.336	0.4791
20,000	0.5328	1.3700	-24.624	-12.323	0.8625	0.929	13.750	0.4595
21,000	0.5150	1.3935	-26.605	-15.889	0.8556	0.925	13.184	0.4406
22,000	0.4976	1.4176	-28.586	-19.456	0.8487	0.921	12.636	0.4223
23,000	0.4807	1.4424	-30.586	-23.022	0.8419	0.918	12.107	0.4046
24,000	0.4642	1.4678	-32.549	-26.588	0.8350	0.914	11.597	0.3876
25,000	0.4481	1.4938	-34.530	-30.154	0.8281	0.910	11.104	0.3711
26,000	0.4325	1.5206	-36.511	-33.720	0.8212	0.906	10.627	0.3552
27,000	0.4173	1.5480	-38.493	-37.286	0.8144	0.902	10.168	0.3398
28,000	0.4025	1.5762	-40.474	-40.852	0.8075	0.899	9.725	0.3250
29,000	0.3881	1.6052	-42.455	-44.419	0.8006	0.895	9.297	0.3107
30,000	0.3741	1.6349	-44.436	-47.985	0.7937	0.891	8.885	0.2970
31,000	0.3605	1.6654	-46.417	-51.551	0.7869	0.887	8.488	0.2837
32,000	0.3473	1.6968	-48.399	-55.117	0.7800	0.883	8.106	0.2709
33,000	0.3345	1.7291	-50.379	-58.683	0.7731	0.879	7.737	0.2586
34,000	0.3220	1.7623	-52.361	-62.249	0.7662	0.875	7.382	0.2467

REMARKS:

(1) One in. of Hg = 70.732 lb per sq ft
0.4912 lb per sq in.

(2) ICAO Standard Sea Level Air
$t_o = 15^oC$
P_o = 29.921 in. of Hg
ao = 661.8 knots
ρ_o = 0.0023769 slug per cu ft

DATA BASIS: NACA Technical Note No. 3182

Figure 11-5. ICAO Standard Altitude Chart (Sheet 1)

Altitude Feet	Density Ratio $\sigma = \rho/\rho o$	$\frac{1}{\sqrt{\sigma}}$	Temperature ^{o}C	Temperature ^{o}F	Temperature Ratio $\theta = T/T_{o}$	Speed of Sound Ratio a/ao	Pressure In. of Hg	Pressure Ratio $\delta = P/P_{o}$
35,000	0.3099	1.7964	-54.342	-65.816	0.7594	0.871	7.041	0.2353
36,000	0.2981	1.8315	-56.323	-69.382	0.7525	0.867	6.712	0.2243
36,089	0.2971	1.8347	-56.500	-69.700	0.7519	0.867	6.683	0.2234
37,000	0.2844	1.8753					6.397	0.2138
38,000	0.2710	1.9209					6.097	0.2038
39,000	0.2585	1.9677					5.811	0.1942
40,000	0.2462	2.0155					5.538	0.1851
41,000	0.2346	2.0645					5.278	0.1764
42,000	0.2236	2.1148					5.030	0.1681
43,000	0.2131	2.1662					4.794	0.1602
44,000	0.2031	2.2189					4.569	0.1527
45,000	0.1936	2.2728					4.355	0.1455
46,000	0.1845	2.3281					4.151	0.1387
47,000	0.1758	2.3848					3.956	0.1322
48,000	0.1676	2.4428					3.770	0.1260
49,000	0.1597	2.5022					3.593	0.1201
50,000	0.1522	2.5630					3.425	0.1145
51,000	0.1451	2.6254					3.264	0.1091
52,000	0.1383	2.6892					3.111	0.1040
53,000	0.1318	2.7546					2.965	0.0991
54,000	0.1256	2.8216					2.826	0.0944
55,000	0.1197	2.8903					2.693	0.0900
56,000	0.1141	2.9606					2.567	0.0858
57,000	0.1087	3.0326					2.446	0.0818
58,000	0.1036	3.1063					2.331	0.0779
59,000	0.09877	3.1819					2.222	0.0743
60,000	0.09414	3.2593					2.118	0.0709
61,000	0.08972	3.3386					2.018	0.0675
62,000	0.08551	3.4198					1.924	0.0643
63,000	0.08150	3.5029					1.833	0.0613
64,000	0.07767	3.5881					1.747	0.0584
65,000	0.07403	3.6754	-56.500	-69.700	0.7519	0.867	1.665	0.0557

REMARKS:

(1) One in. of Hg = 70.732 lb per sq ft
= 0.4912 lb per sq in.

DATA BASIS: NACA Technical Note No. 3182

(2) ICAO Standard Sea Level Air
$t_{o} = 15^{o}C$
P_{o} = 29.921 in. of Hg
ao = 661.8 knots
ρ_{o} = 0.0023769 slug per cu ft

Figure 11-5. ICAO Standard Altitude Chart (Sheet 2)

AIRSPEED — ALTITUDE — MACH NUMBER
CORRECTION FOR POSITION ERROR
(CRUISE AND POWER APPROACH CONFIGURATIONS)

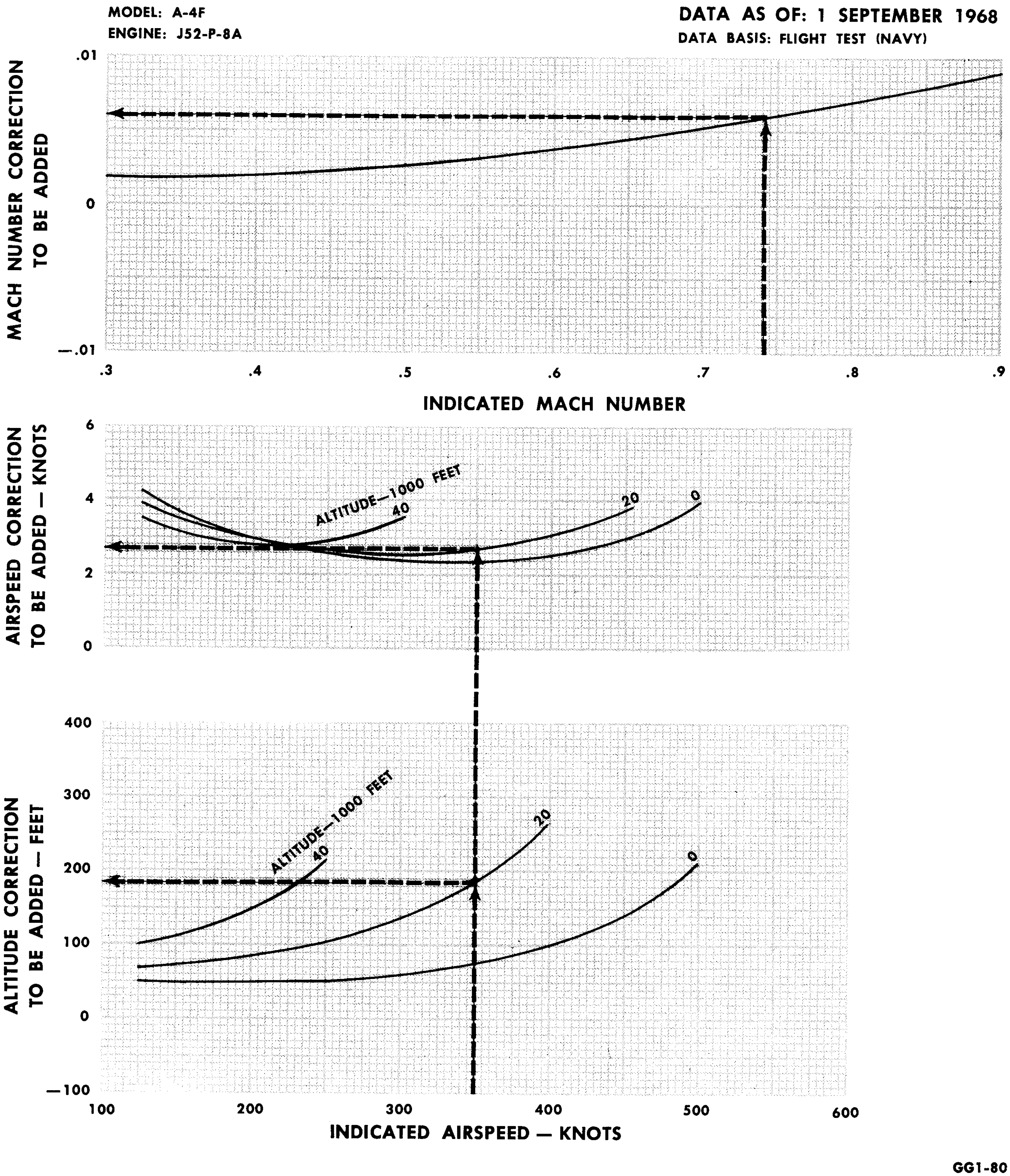


Figure 11-6. Airspeed — Altitude — Mach Number Correction for Position Error (Cruise and Power Approach Configurations)

AIRSPEED AND ALTITUDE CORRECTION FOR POSITION ERROR
AFC-240 INSTALLED

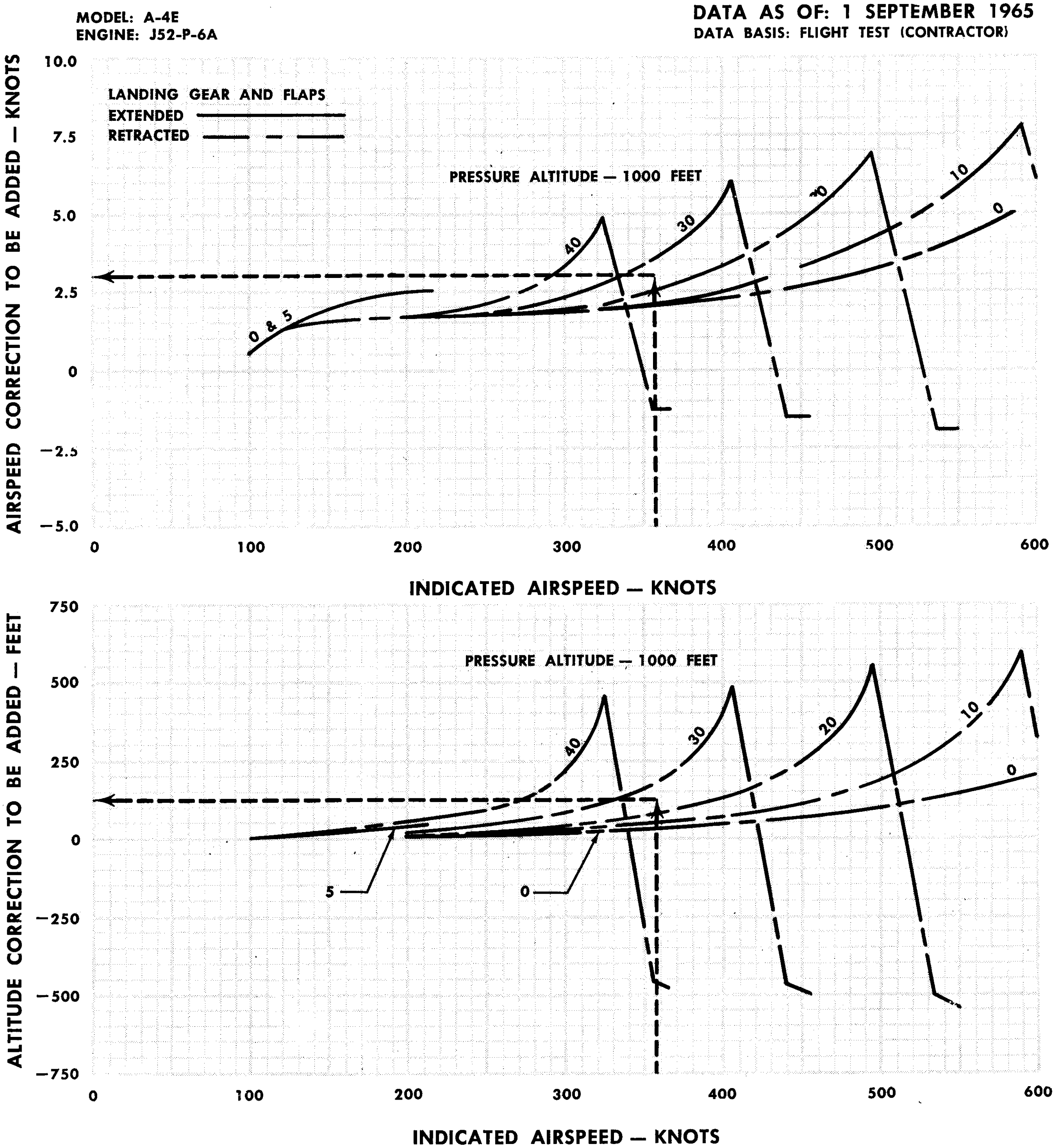


Figure 11-7. Airspeed and Altitude Correction for Position Error

MACH NUMBER CORRECTION
FOR POSITION ERROR
AFC-240 INSTALLED

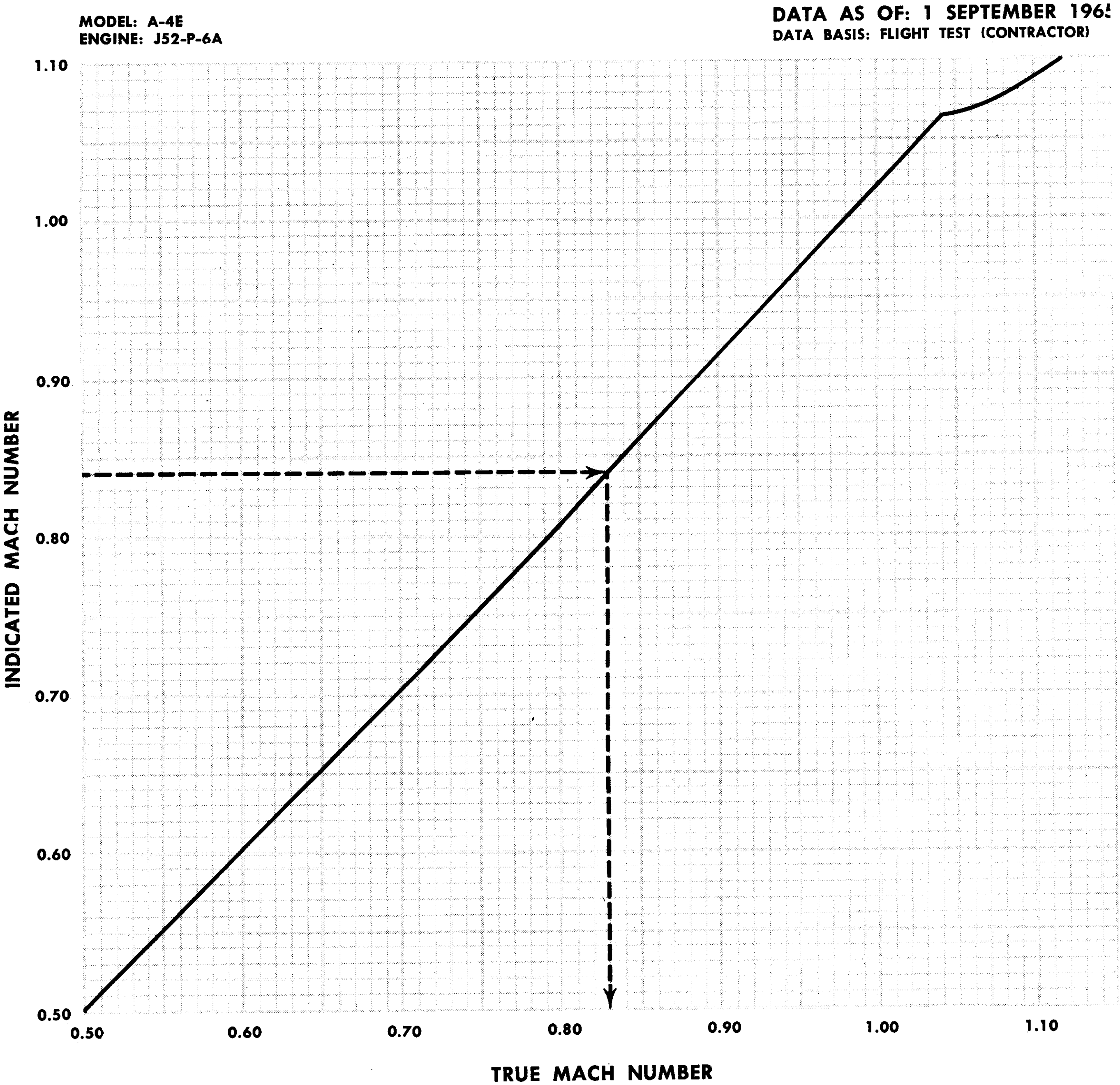


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Figure 11-8. Mach Number Correction for Position Error

PART 2
TAKEOFF

Takeoff Charts

The takeoff charts present takeoff distance, maximum takeoff weight, JATO firing delay, and JATO takeoff distance. The charts encompass such variables as takeoff weight, equivalent airspeed, ambient runway temperature, runway pressure altitude, headwind, and runway gradient. Half flaps and MILITARY thrust are recommended for all takeoffs.

Variables, which are not considered in the charts, that will influence the acceleration of the aircraft during ground run are pilot braking to maintain directional control; runway surface conditions which constitute a lower or higher value for the rolling coefficient of friction (μ); external store loadings on the wing stations which protrude forward or near the leading edge of the wing and influence the flow field of air over the wing, reducing lift and increasing required takeoff speeds; and rough or bumpy runways which influence the taxi attitude of the aircraft, introducing aerodynamic braking during the ground run. Of these variables, pilot braking, which is a function of pilot technique, probably has the greatest influence on acceleration-retardation and will increase the ground run significantly.

Operational Takeoff Distance

Operational takeoff distance, total distance to clear a 50-foot obstacle, without JATO assist, and recommended takeoff speeds are shown in figures 11-10 and 11-49. Takeoff distances are based on half flaps, MILITARY thrust, and 8 degrees aircraft noseup trim.

The takeoff airspeeds and distances are based on NATC flight test data of the Model A-4E aircraft. Note the region in the altitude correction box where MAXIMUM TAKEOFF WEIGHT MAY BE EXCEEDED. This region represents an area in which the minimum acceptable thrust-to-weight ratio may be encountered, resulting in marginal climbout capability, or the safe tire limit speed of 175 knots ground speed may be exceeded. Since temperature and altitude are not independent, the boundary lines in this box are shown for extreme altitude-temperature combinations. A more detailed explanation of the marginal region is given under maximum takeoff weight. The method of obtaining the ground run distance, total distance to clear a 50-foot obstacle, and takeoff airspeed, and the line speed check are described in the following example.

NOTE

If operational conditions require takeoffs for which computed takeoff distance places the aircraft in the region labeled TAKEOFF IS MARGINAL on the chart, lift-off speed should be increased approximately 5 to 10 knots, not to exceed tire limiting speed. This will result in increased rates of climb. Runway length and location of abort gear must be considered in planning this type of takeoff.

SAMPLE PROBLEM

Takeoff Distance — Operational

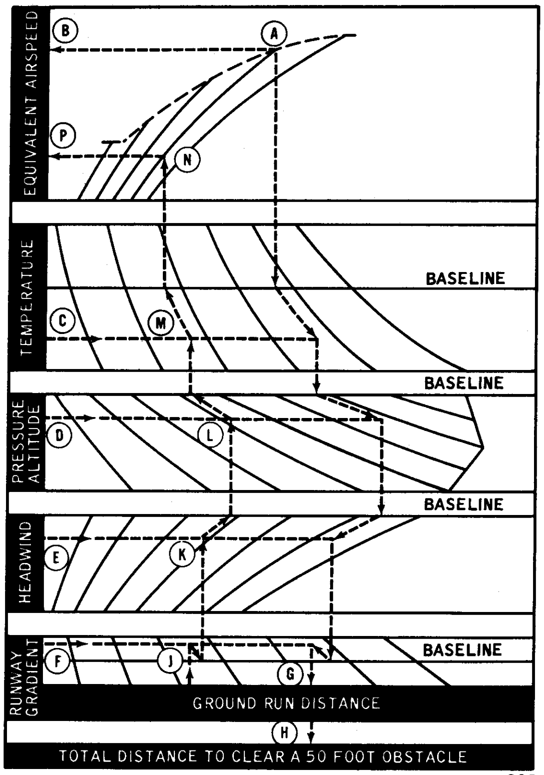
(For figure 11-10)

(A)	Takeoff weight.	20,000 pounds
(B)	Takeoff airspeed	146 KEAS
(C)	Ambient runway air temperature	30^oC
(D)	Runway pressure altitude	2000 feet
(E)	Headwind	10 knots
(F)	Runway gradient	-2 percent
(G)	Ground run distance	3150 feet
(H)	Total distance to clear 50-foot obstacle	4500 feet

Line Speed Check

A line speed check is a simple procedure for determining that aircraft acceleration during takeoff is normal, sufficiently early in the takeoff run to allow normal braking to stop the aircraft on the runway. The pilot selects a suitable and recognizable known distance down the runway from the point that takeoff run commences (such as runway distance marker, runway intersection, etc). The normal takeoff distance chart is used by entering the chart at the selected distance and working in reverse through the chart, applying the corrections for variation from standard conditions. The first line speed check should be made at the 2000-foot runway marker.

SAMPLE TAKEOFF DISTANCE



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(J) Runway gradient . . . . -2 percent

(K) Headwind . . . . 10 knots

(L) Runway pressure altitude. . . . . . . 2000 feet

(M) Ambient runway air temperature . . . . $30^{o}C$

(N) Takeoff weight. . . . . 20, 000 pounds

(P) Equivalent airspeed . . . . 119 KEAS

Maximum Takeoff Weight — With and Without JATO

The maximum takeoff weight (figures 11-11 and 11-50) is given as a function of pressure altitude and ambient air temperature. The data basis for this chart assumes that the landing gear is fully extended, takeoff is at airspeeds shown in figures 11-10 and 11-49, the aircraft is climbing out with MILITARY thrust with the assist of ground effect, multiple carriage stores are carried on wing stations, and wing flaps are set at the half-flaps position.

The maximum takeoff weight criteria is based on the most critical of the following:

1. Excess thrust shall not be less than minimum established by NATC flight test.

2. The safe tire speed limit of 175 knots ground speed shall not be exceeded.

NATC flight test of the Model A-4E aircraft shows that the above criteria, when met, will provide acceptable climbout characteristics. Since JATO burnout occurs at lift-off, this chart is valid for both with and without JATO assist.

SAMPLE PROBLEM

Maximum Takeoff Weight – Operational

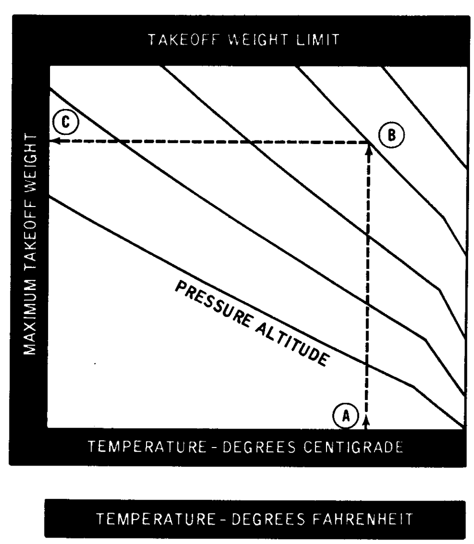
(For figure 11-11)

(A) Ambient runway air temperature . . . . $30^{o}C$

(B) Runway pressure altitude . . . . 4000 feet

(C) Maximum takeoff weight . . . . . . 23, 220 pounds

SAMPLE MAXIMUM TAKEOFF WEIGHT



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JATO firing Delay, Minimum Takeoff Distance — Two MK 7 MOD 2, 5KS-4500 JATO Bottles

The minimum ground run distance and the total distance to clear a 50-foot obstacle may be realized by firing the JATO bottles so that burnout occurs at lift-off. Burnout at lift-off is recommended for the following reasons:

1. Burnout at lift-off produces the shortest takeoff distance.

2. A misfire can be detected early and the takeoff can be aborted well before the refusal point.

The following trim settings are required for JATO operation to avoid excessive nose-high attitudes at low gross weights due to noseup pitching moments generated by possible JATO burning after lift-off.

Gross Weight (Pounds)	Recommended Trim (Degrees Noseup)
13,500	2
17,500	5
22,500	7
24,500	8

With the above recommended trim settings, the flight trim stick force without JATO burning varies linearly with gross weight from approximately 12 pounds pull at 16,000 pounds gross weight to 3 pounds pull at 24,500 pounds gross weight. This stick force is not objectionable since a reduction in angle-of-attack is required to maintain airspeed or to continue acceleration.

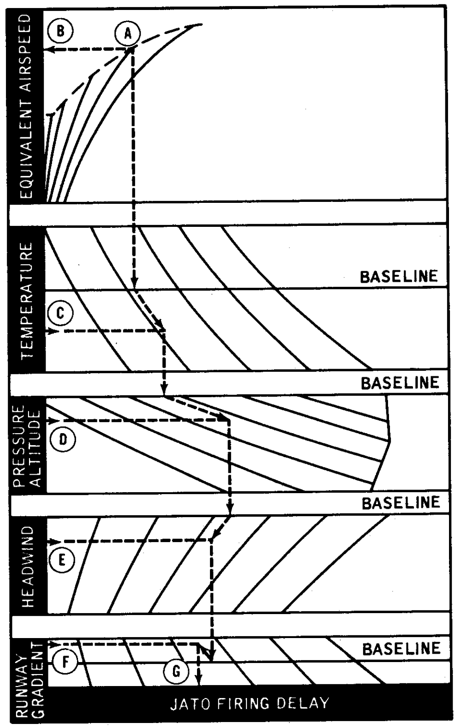
It is recommended that the firing point be established by distance markers alongside the runway. This recommendation is made for the following reasons:

1. Using a time interval from brake release is considered to be too inaccurate.

2. Using airspeed as a reference for JATO firing would not be possible since, generally, JATO firing occurs at a speed below the speed at which the airspeed indicator begins to register.

Figures 11-12 and 11-51 show the ground run distance from brake release to ignition of JATO. Takeoff speed, ground run distance, and total horizontal distance to clear a 50-foot obstacle are presented in figures 11-13 and 11-52. Takeoff distances are based on preceding half-flaps, military thrust, and trim settings.

SAMPLE JATO FIRING DELAY



GG1-117

The takeoff airspeeds and distances are based on JATO flight test data of the Model A-4E aircraft. Note the region in the altitude correction box where MAXIMUM TAKEOFF WEIGHT MAY BE EXCEEDED. This region represents an area in which the minimum acceptable thrust-to-weight ratio may be encountered, resulting in marginal climbout capability, or the safe tire limiting speed at 175 knots ground speed may be exceeded. Since temperature and altitude are not independent, the boundry lines in this box are shown for extreme altitude-temperature combinations. A more detailed explanation of the marginal region is given under Maximum Takeoff Weight. The method of obtaining the JATO firing distance, JATO takeoff airspeed, JATO ground run distance, and total distance to clear a 50-foot obstacle is described in the following examples.

SAMPLE PROBLEM

JATO FIRING Delay

(For figure 11-12)

(A) Takeoff weight . . . . 20,000 pounds

(B) Takeoff airspeed . . . . 146 KEAS

(C) Ambient runway air temperature . . . . 30^oC

(D) Runway pressure altitude . . . . 2000 feet

(E) Headwind . . . . 10 knots

(F) Runway gradient . . . . -2 percent

(G) JATO firing distance. . . . . 850 feet

JATO Takeoff Distance

(For figure 11-13)

(H) Takeoff weight. . . . . 20, 000 pounds

(J) Takeoff airspeed . . . . 146 KEAS

(K) Ambient runway air temperature . . . . $30^{o}C$

(L) Runway pressure altitude . . . . 2000 feet

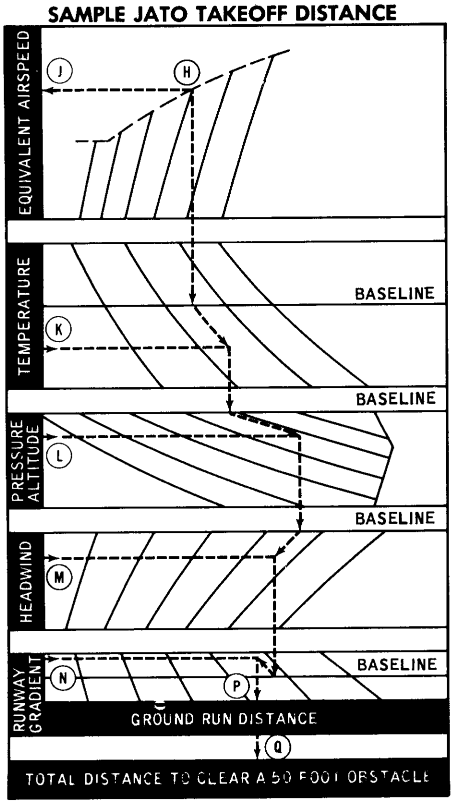
(M) Headwind . . . . 10 knots

(N) Runway gradient . . . . -2 percent

(P) Ground run distance . . . . 1710 feet

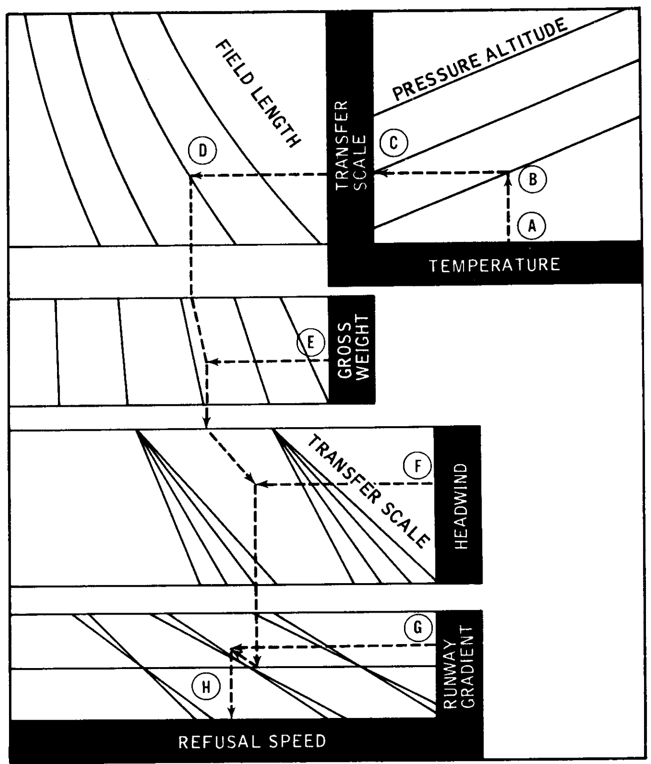
(Q) Total distance to clear 50-foot obstacle . . . . 3000 feet

SAMPLE JATO TAKEOFF DISTANCE



GG1-118

SAMPLE TAKEOFF REFUSAL SPEED



HH1-230

Refusal Speed

The maximum refusal speed is that speed at which engine failure permits stopping the aircraft on a runway of specified length. Figures 11-14 and 11-53 present this data for engine failure during a military thrust takeoff without JATO burning. Data includes distance covered during a pilot reaction time of 2 seconds and for an 8-second engine deceleration time from military to idle rpm.

SAMPLE PROBLEM

Takeoff Refusal Speeds

(For figure 11-14)

Configuration: All configurations

(A) Runway temperature . . . . $10^{o}C$

(B) Runway pressure altitude . . . . 2000 ft

(C) Transfer scale 0.78

(D) Field length . . . . 8000 ft

(E) Takeoff weight . . . . 18,000 lb

(F) Headwind . . . . 10 kn

(G) Runway gradient . . . . -1 percent

(H) Takeoff refusal speed . . . . 108 KIAS

Brake-on Speed Check

(For figure 11-54)

(J) Brake-on speed . . . . above 200 KIAS

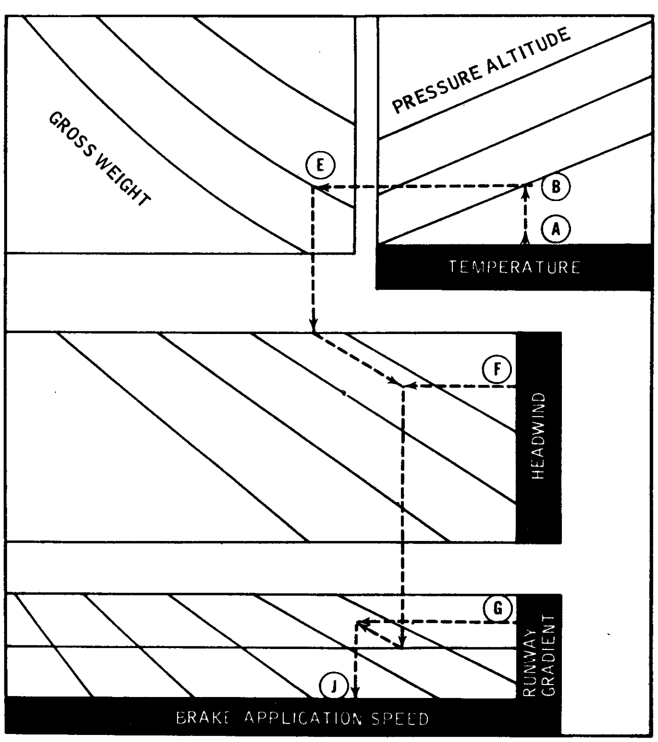
NOTE

If brake-on speed is less than takeoff refusal speed, brakes should not be applied until aircraft has decelerated to brake-on speed.

Stopping Distance

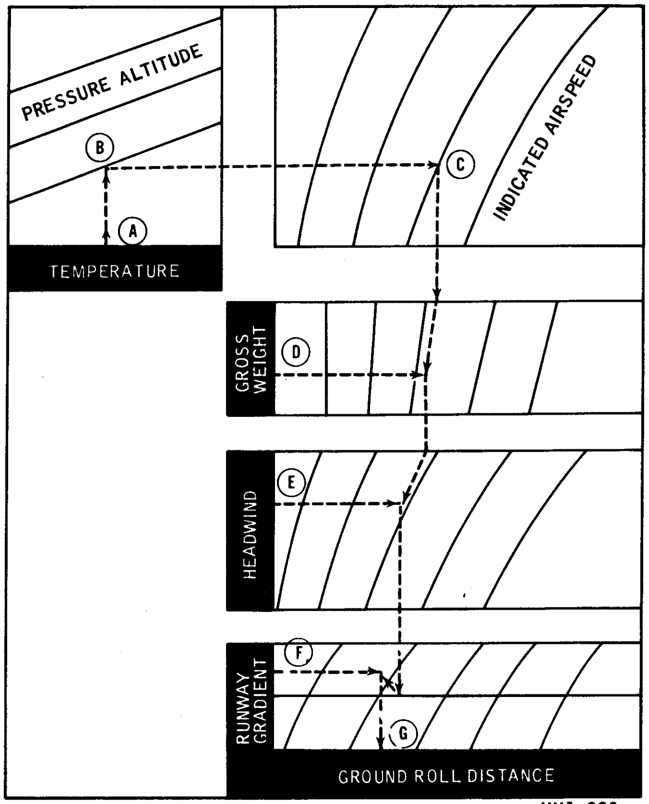
The stopping distance chart (figures 11-15 and 11-55) is included primarily for use if the takeoff should be aborted. It is not intended for use in determining landing distance. The data does not include pilot reaction and deceleration time. Distances are based on the application of maximum braking effort without skidding the tires, below brake energy limit speed, and throttle positioned at idle thrust. To minimize diversion of pilot's attention during this critical stage of the takeoff abort, it is recommended that flaps be left in the position selected for takeoff.

SAMPLE BRAKE APPLICATION SPEED



HH1-225

SAMPLE STOPPING DISTANCE



HH1-231

NOTE

Shutting down the engine at 80 KIAS will shorten the rollout considerably.

SAMPLE PROBLEM

Stopping Distance

(For figure 11-15)

Configuration: All Configurations

(A) Runway temperature . . . . 10^{o}C

(B) Runway pressure altitude . . . . 2000 ft

(C) Indicated airspeed at abort . . . . 108 KIAS

(D) Aircraft gross weight . . . . 18,000 lb

(E) Headwind . . . . 10 kn

(F) Runway gradient . . . . +1 percent

(G) Stopping distance . . . . 4350 ft

TAKEOFF DISTANCE

OPERATIONAL (8° NOSEUP TRIM)

HALF FLAPS

NO JATO

MODEL: A-4F
ENGINE: J52-P-8A

DATA AS OF: NOVEMBER 1968
DATA BASIS: FLIGHT TEST (NAVY)

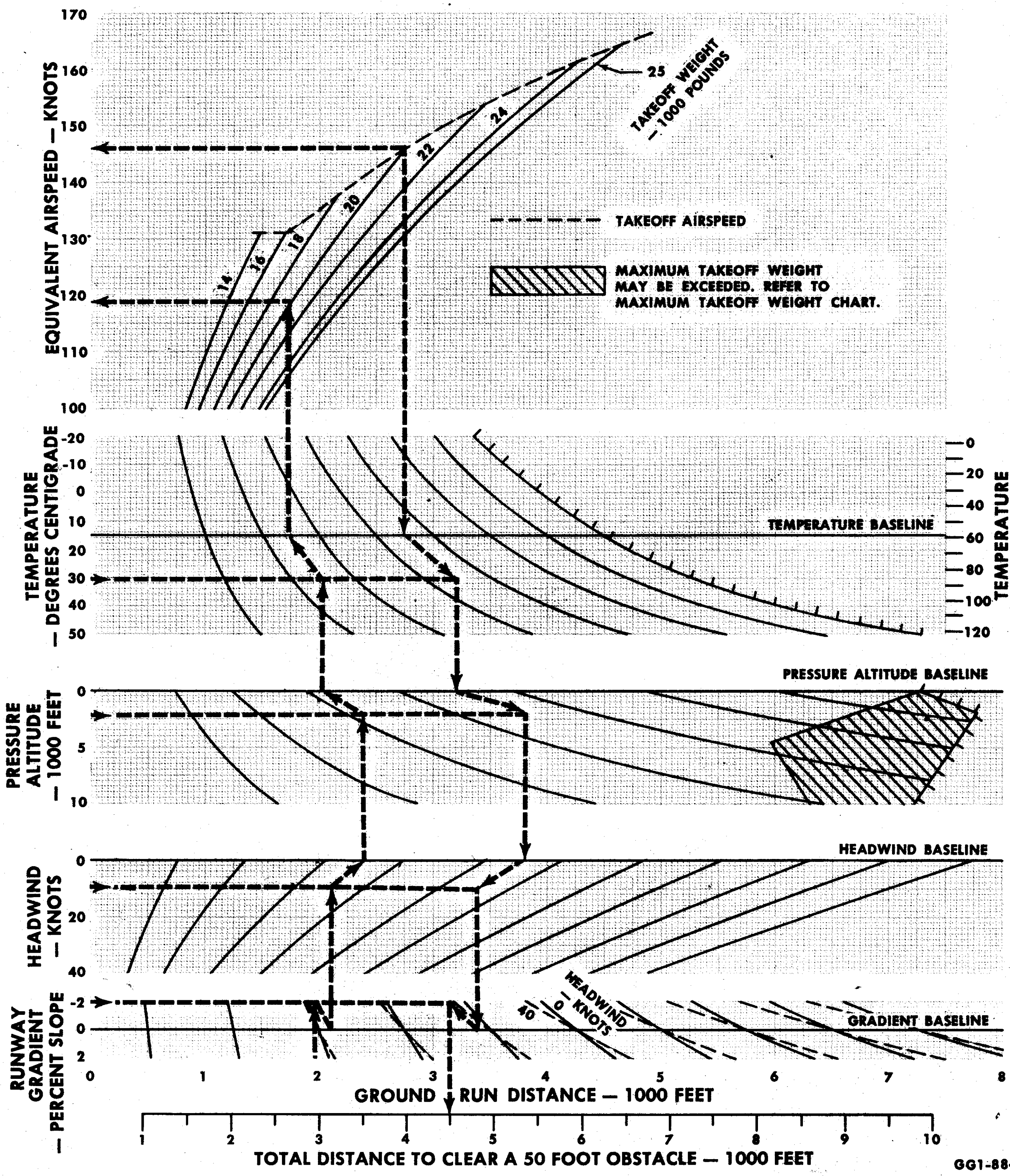


Figure 11-10. Takeoff Distance

MAXIMUM TAKEOFF WEIGHT

HALF FLAPS

WITH AND WITHOUT JATO

MODEL: A-4F
ENGINE: J52-P-8A

DATA AS OF: NOVEMBER 1968
DATA BASIS: FLIGHT TEST (NAVY)

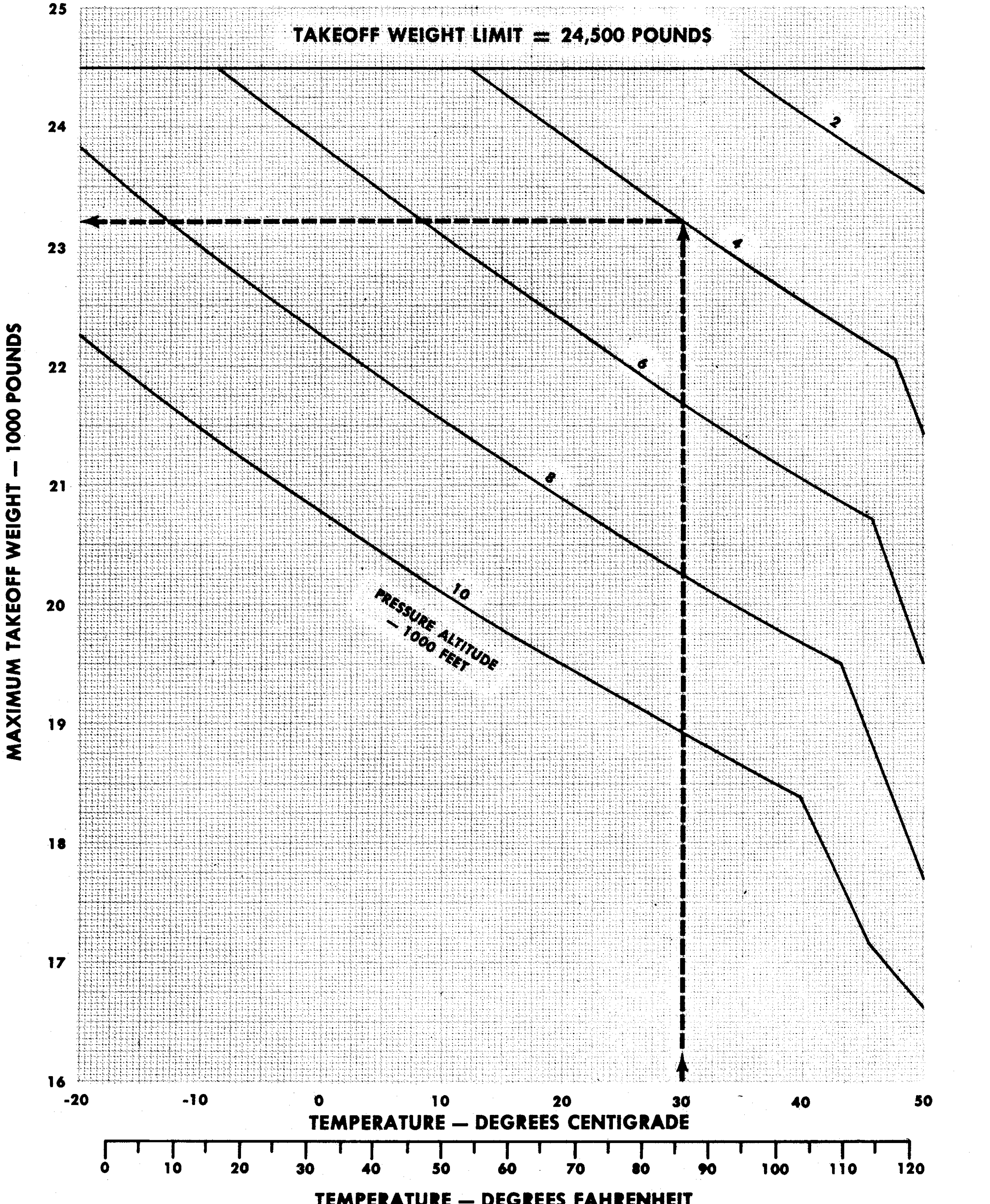


Figure 11-11. Maximum Takeoff Weight

JATO FIRING DELAY

HALF FLAPS

TWO JATO UNITS

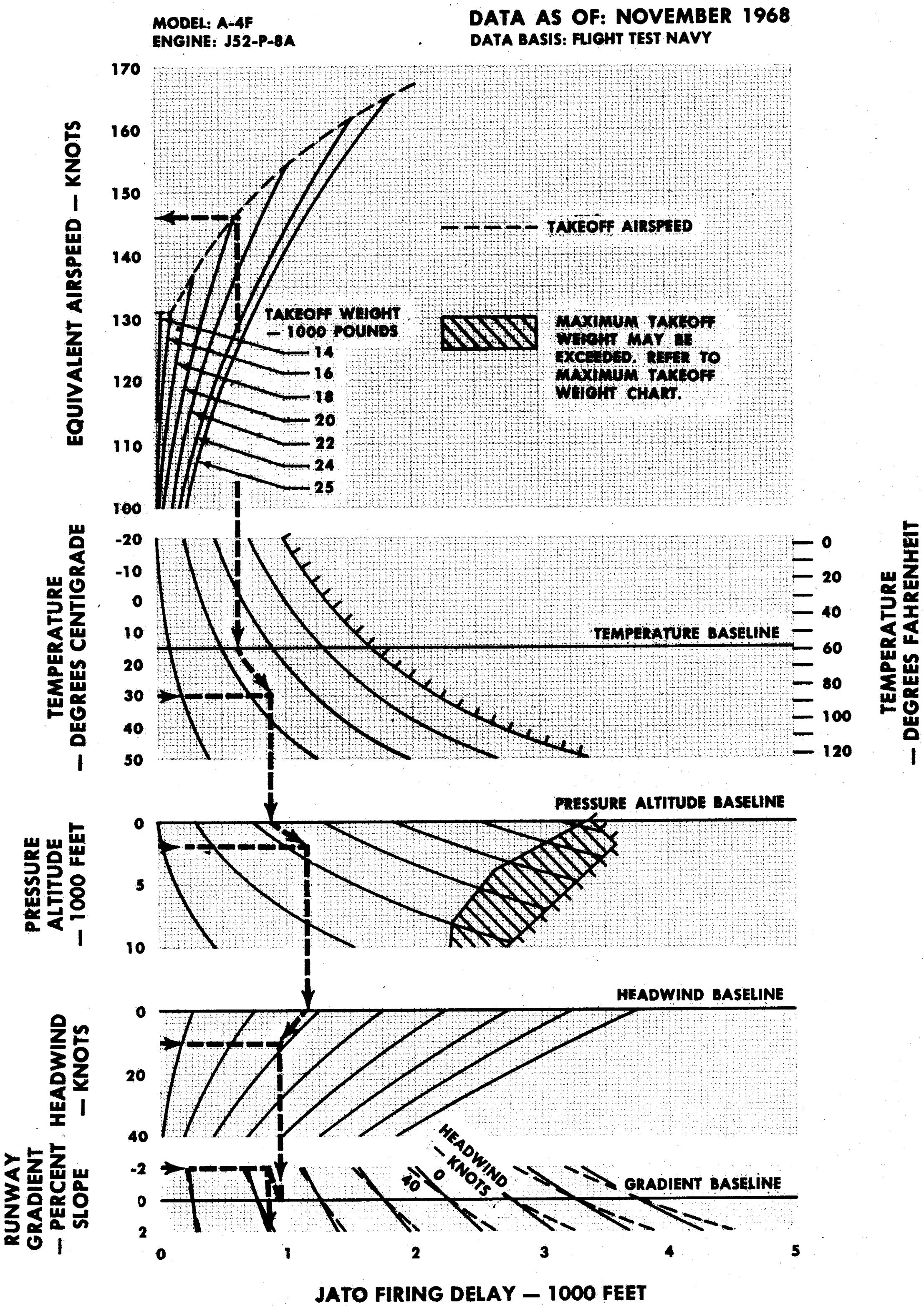


Figure 11-12. JATO Firing Delay

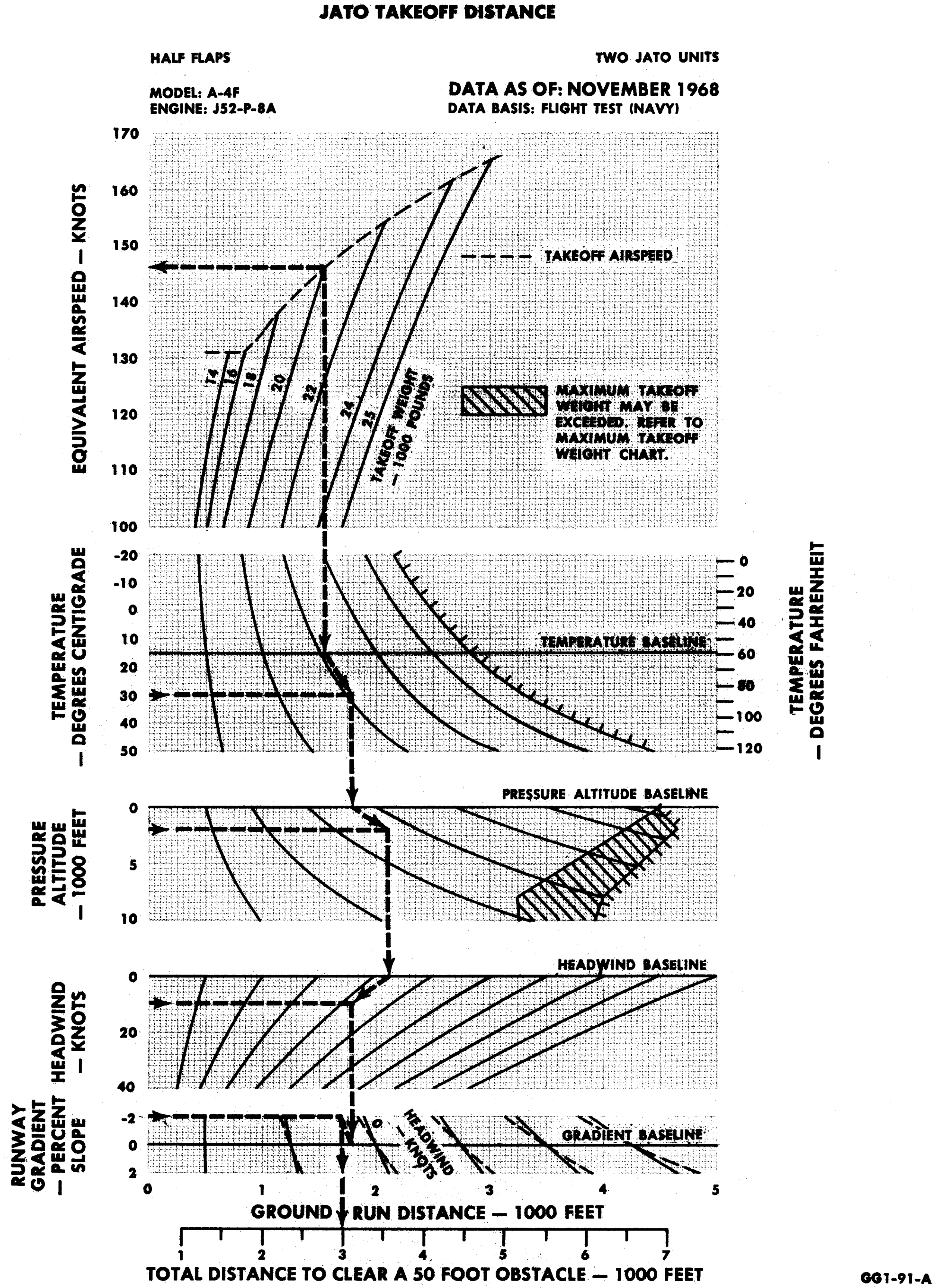


Figure 11-13. JATO Takeoff Distance

 Pages 11-27 thru 11-30 Deleted.

MAXIMUM TAKEOFF WEIGHT
MULTIPLE BOMBS ON WINGS
OPERATIONAL (6° NOSE UP TRIM)

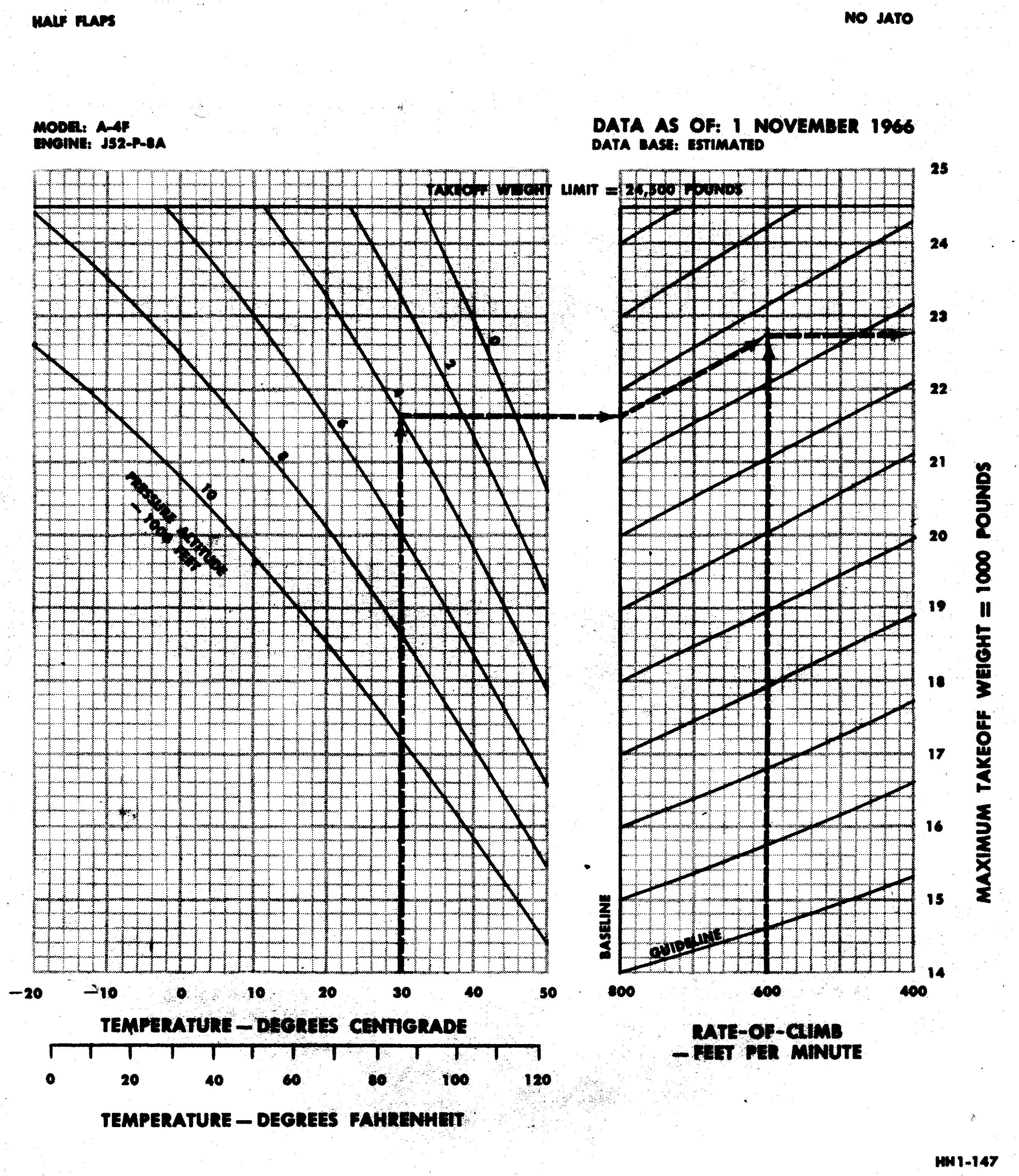


Figure 11-11. Maximum Takeoff Weight (Sheet 1)

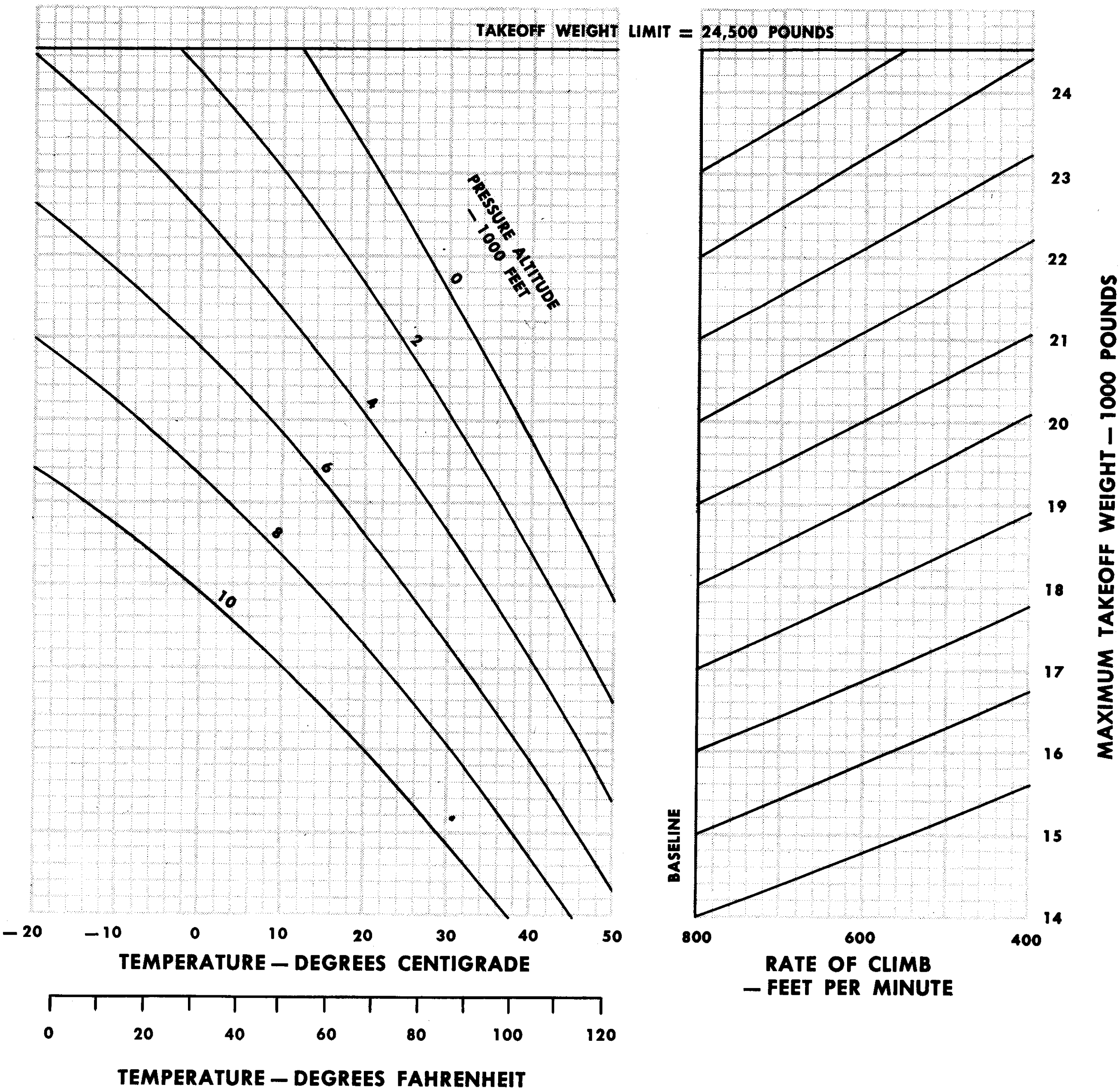
MAXIMUM TAKEOFF WEIGHT
MULTIPLE BOMBS ON WINGS
MINIMUM (12° FULL NOSE UP TRIM)

HALF FLAPS

WITH AND WITHOUT JATO

MODEL: A-4F
ENGINE: J52-P-8A

DATA AS OF: 1 NOVEMBER 1966
DATA BASIS: ESTIMATED



HH1-148

Figure 11-11. Maximum Takeoff Weight (Sheet 2)

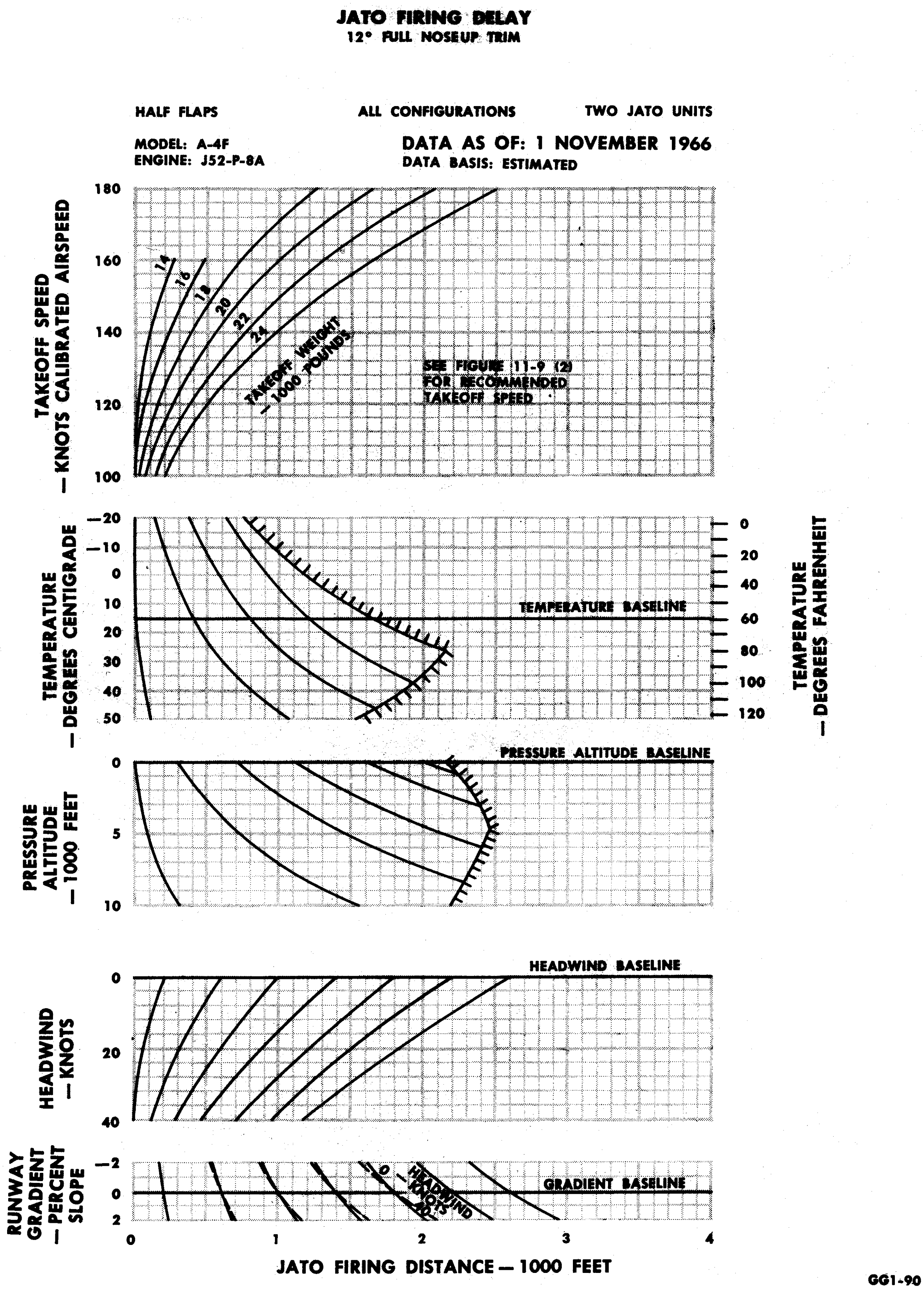


Figure 11-12. JATO Firing Delay

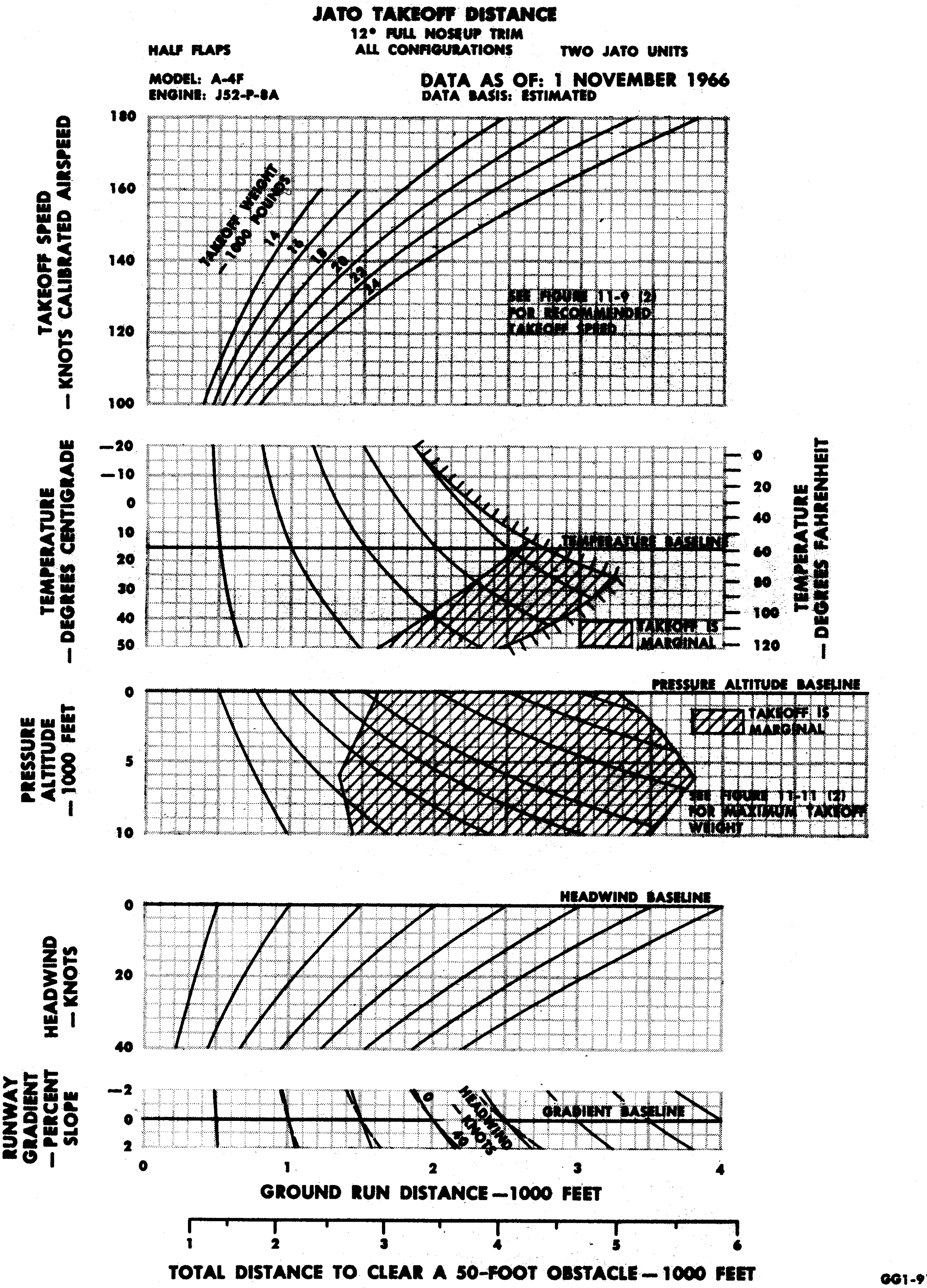


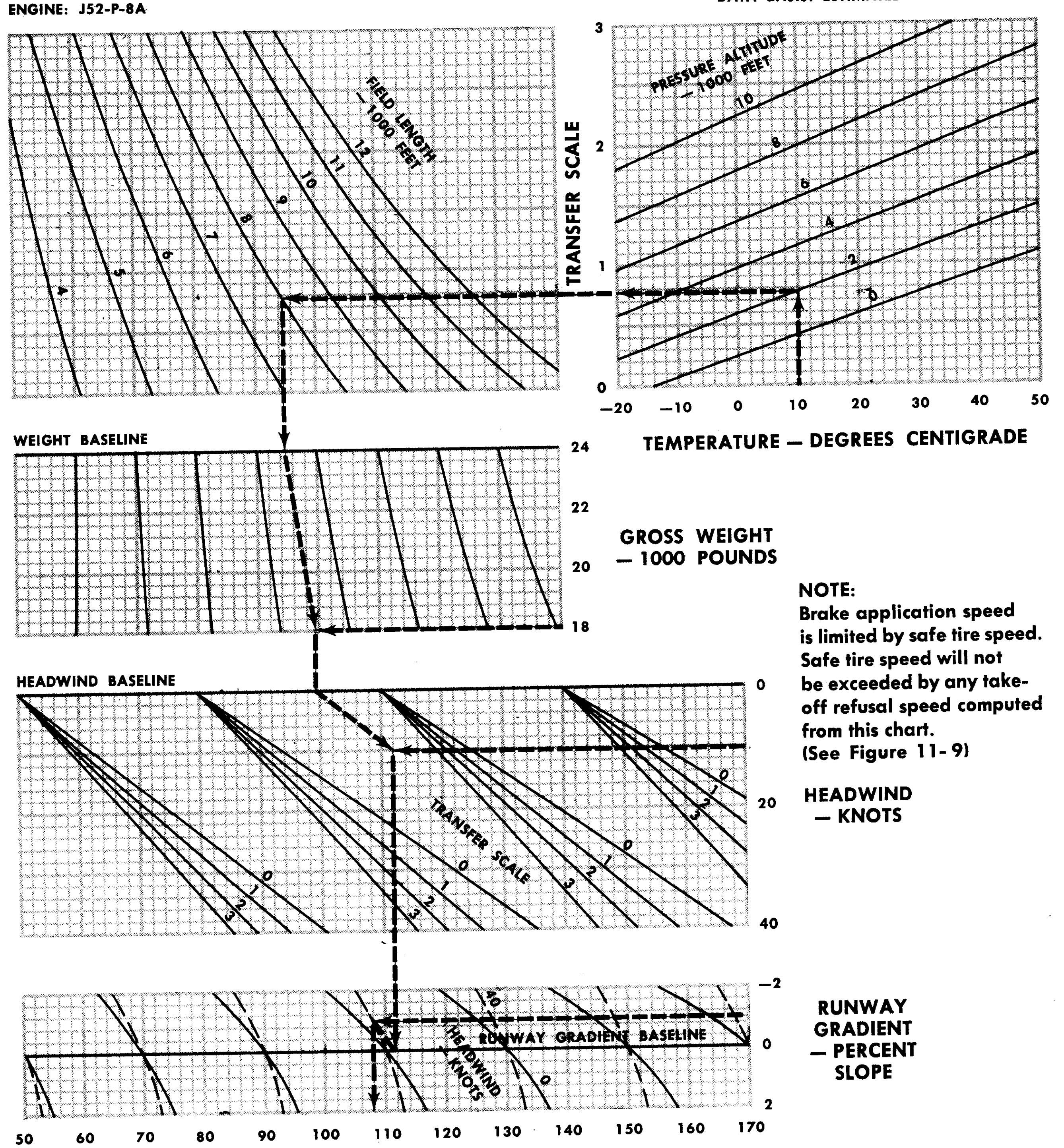
Figure 11-13. JATO Takeoff Distance

TAKEOFF REFUSAL SPEED

HALF FLAPS
SPEEDBRAKES OPEN
SPOILERS OPEN

MODEL: A-4F
ENGINE: J52-P-8A

DATA AS OF: 1 JANUARY 1967
DATA BASIS: ESTIMATED



NOTE:
Brake application speed is limited by safe tire speed. Safe tire speed will not be exceeded by any takeoff refusal speed computed from this chart. (See Figure 11-9)

GG1-92

Figure 11-14. Takeoff Refusal Speeds

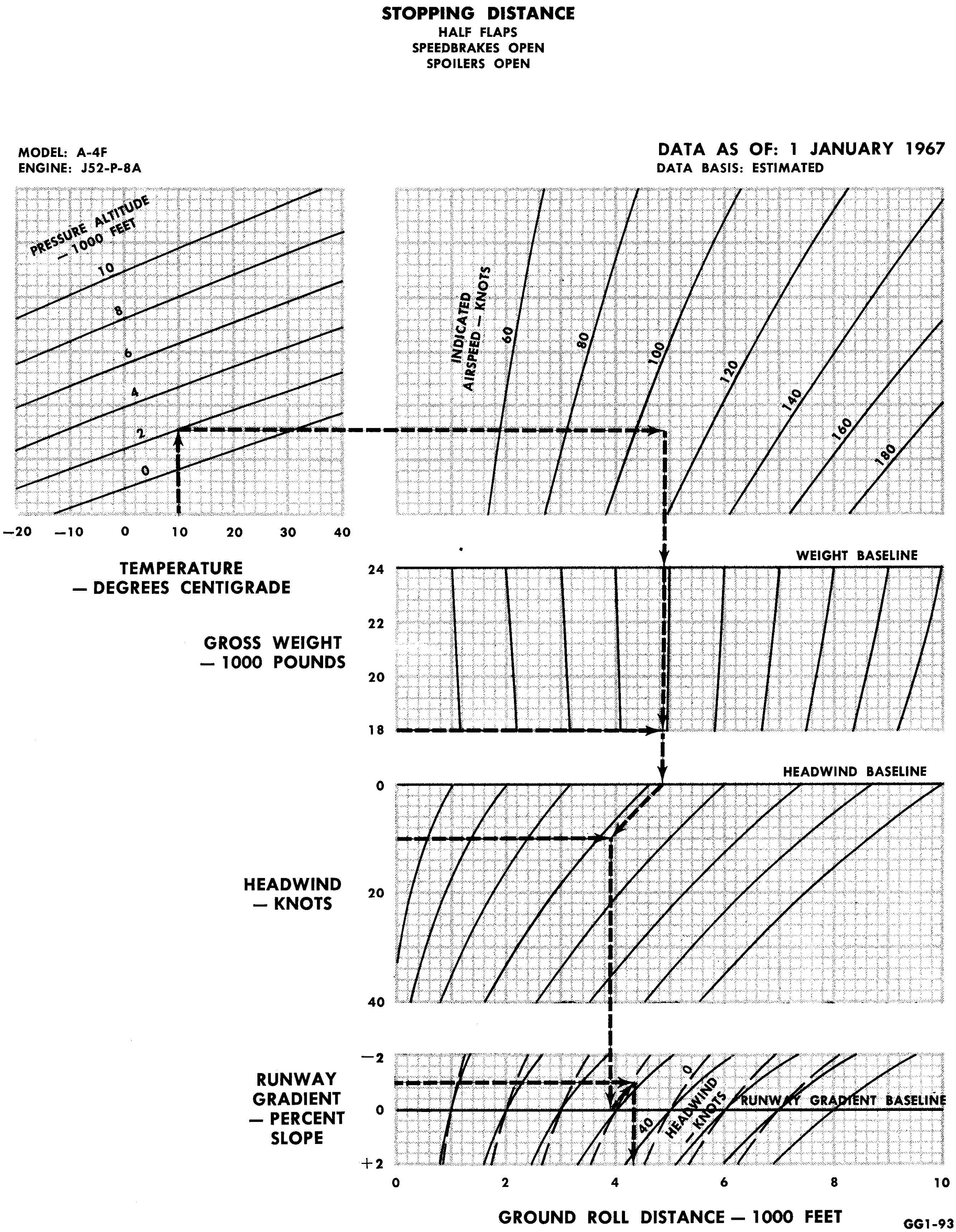


Figure 11-15. Stopping Distance

PART 3
CLIMB

Climb

Climb charts (figures 11-16 through 11-19 and 11-56 through 11-59) present the climb performance for all drag index configurations with the engine operating at military thrust. Climb speeds are presented in figures 11-16 and 11-56 as a function of drag index but independent of gross weight. The climb speed schedule is based on minimum time to climb to altitude. This schedule does not represent a maximum range climb.

The method of presenting data for fuel, distance, and time charts are identical. Therefore, only one sample problem is shown. This performance data is based on the climb speeds shown in figures 11-16 and 11-56.

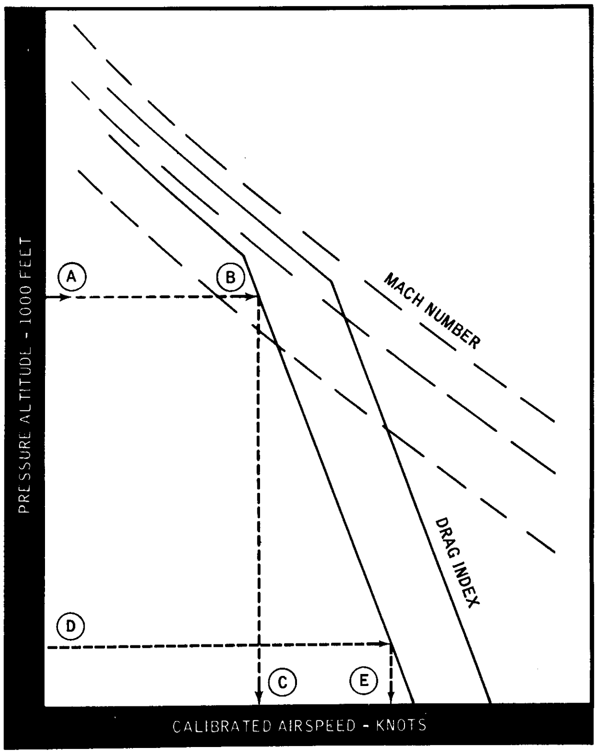
SAMPLE PROBLEM

Climb Speed Schedule

(For figure 11-16)

(A)	Cruise altitude	25,000 ft
(B)	Drag index	50
(C)	Climb speed at cruise altitude	303 KCAS
(D)	Initial climb altitude	5000 ft
(E)	Climb speed at initial altitude	337 KCAS
	Climb speed decrease per 5000-foot increase in altitude	8.5 KCAS

SAMPLE CLIMB SPEED SCHEDULE



HH1-151

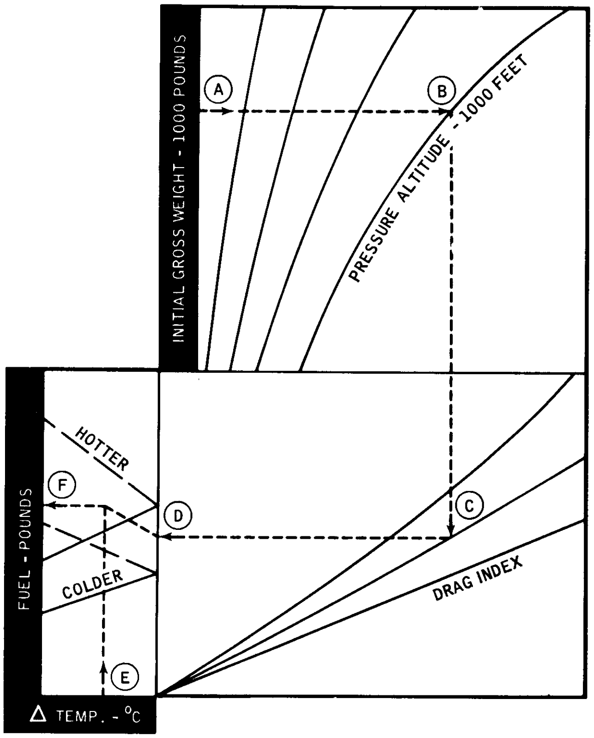
SAMPLE PROBLEM

Climb Fuel

(For figure 11-17)

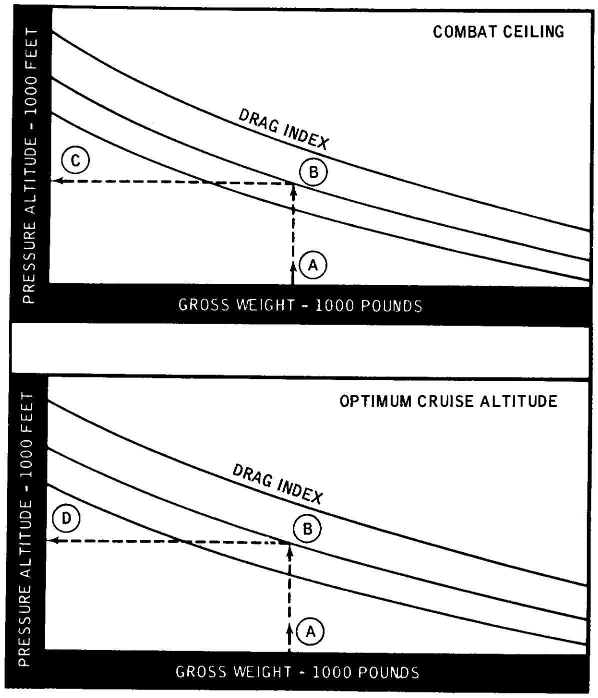
(A)	Initial gross weight	16,000 lb
(B)	Cruise altitude	25,000 ft
(C)	Drag index	50
(D)	Temperature baseline	
(E)	Temperature deviation from ICAO standard day	+10°C
(F)	Fuel to climb from sea level	430 lb

SAMPLE CLIMB FUEL



HH1-152

SAMPLE COMBAT CEILING AND OPTIMUM CRUISE ALTITUDE



HH1-153

Combat Ceiling and Optimum Cruise Altitude

This chart presents the maximum altitude for practical operation and the optimum cruise altitude; the altitude that will produce the maximum distance per pound of fuel. Note that as fuel is burned off and the aircraft becomes lighter in weight the optimum cruise altitude and combat ceiling increase. The complete range of operating gross weights and drag indexes are included.

SAMPLE PROBLEM

Combat Ceiling and Optimum Cruise Altitude

(For figure 11-20)

(A) Aircraft gross weight . . . . 16,000 lb

(B) Drag index 50

(C) Combat ceiling . . . . 39,800 ft

(D) Optimum cruise altitude . . . . 35,000 ft

CLIMB SPEED SCHEDULE
MILITARY THRUST

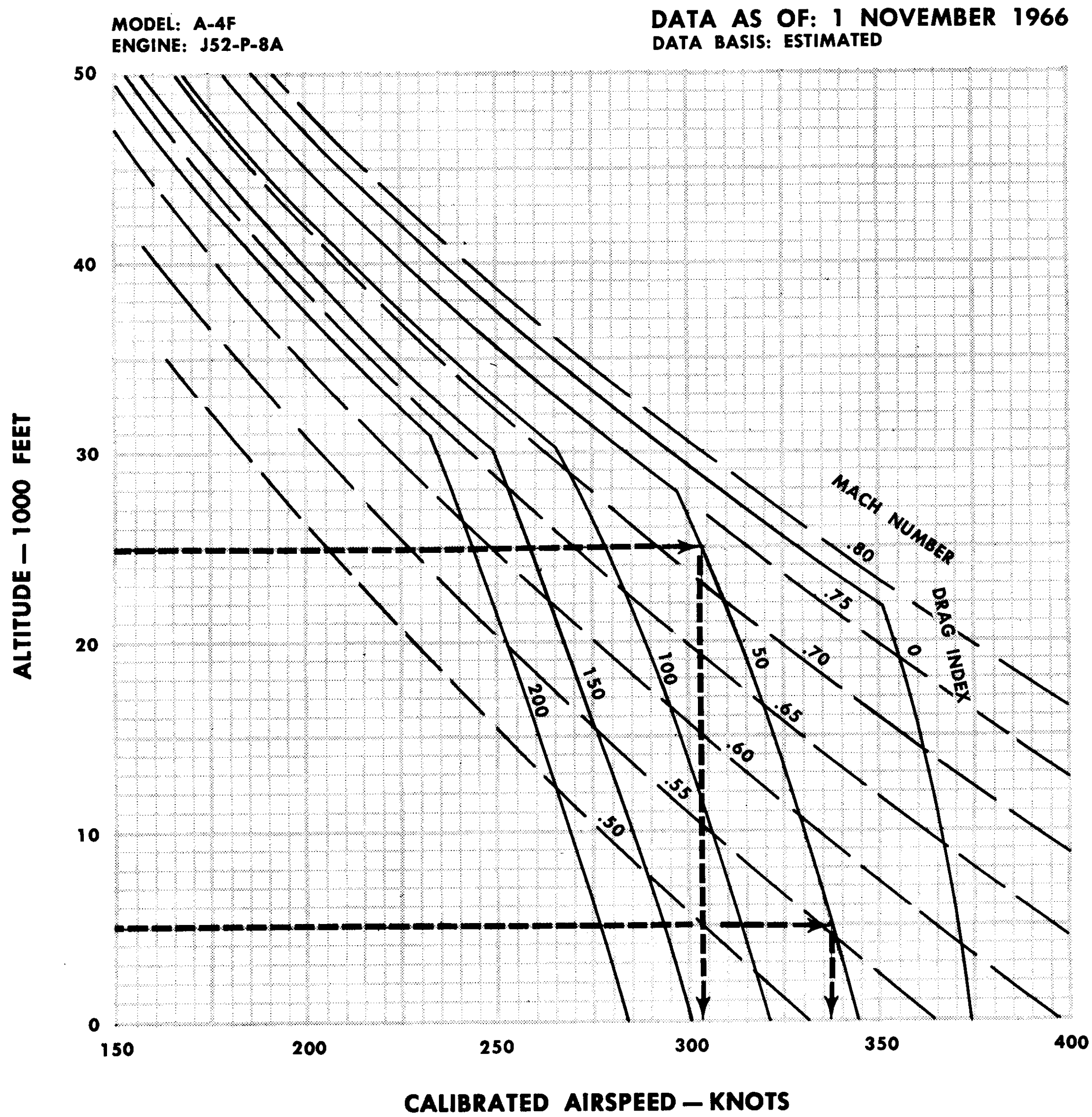
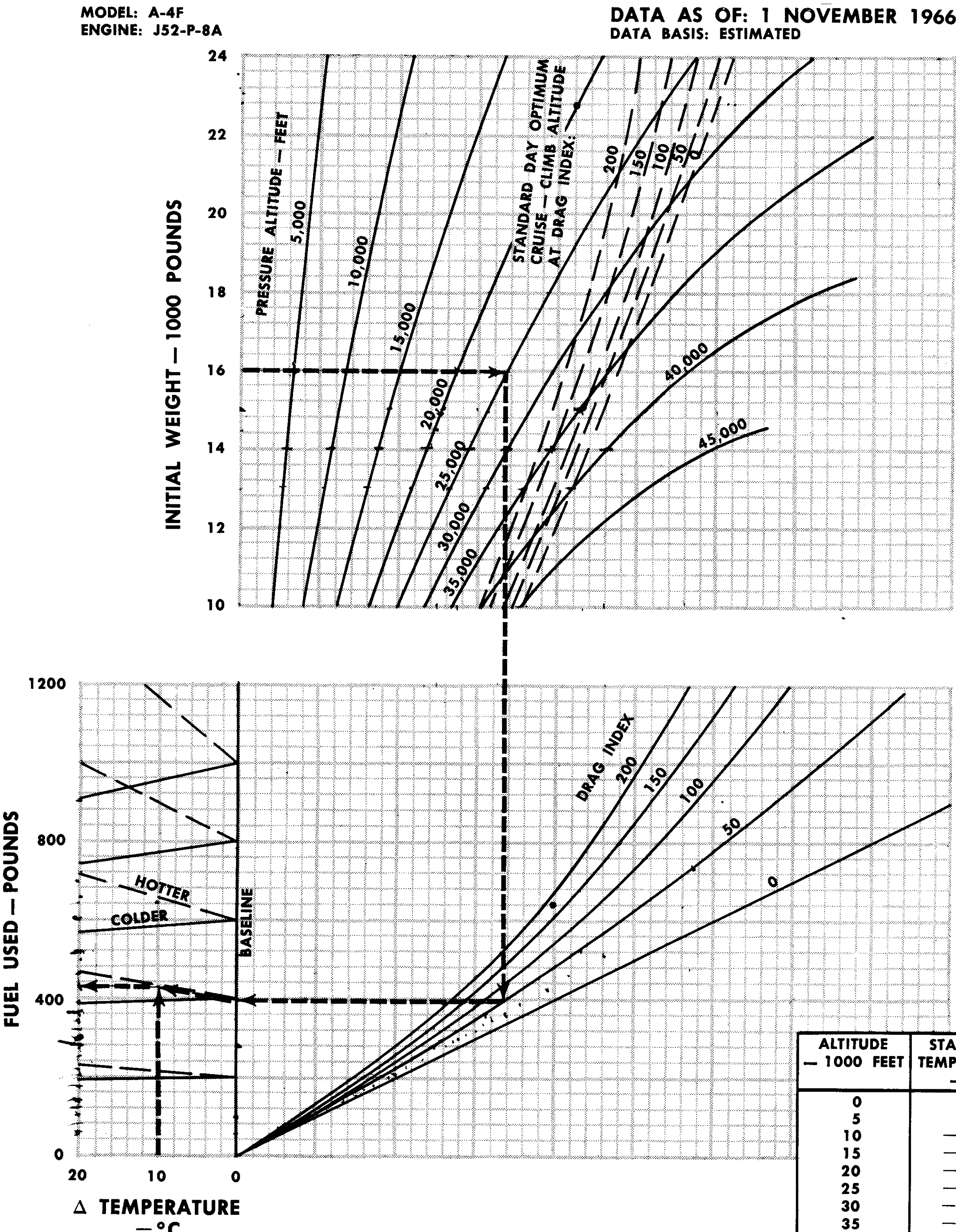


Figure 11-16. Climb Speed Schedule

MILITARY THRUST CLIMB
FUEL USED



ALTITUDE — 1000 FEET	STANDARD TEMPERATURE — °C
0	15.0
5	5.1
10	− 4.8
15	−14.7
20	−24.6
25	−34.5
30	−44.4
35	−54.3
40	−56.5

HH1-155

Figure 11-17. Climb Fuel

MILITARY THRUST CLIMB
DISTANCE COVERED

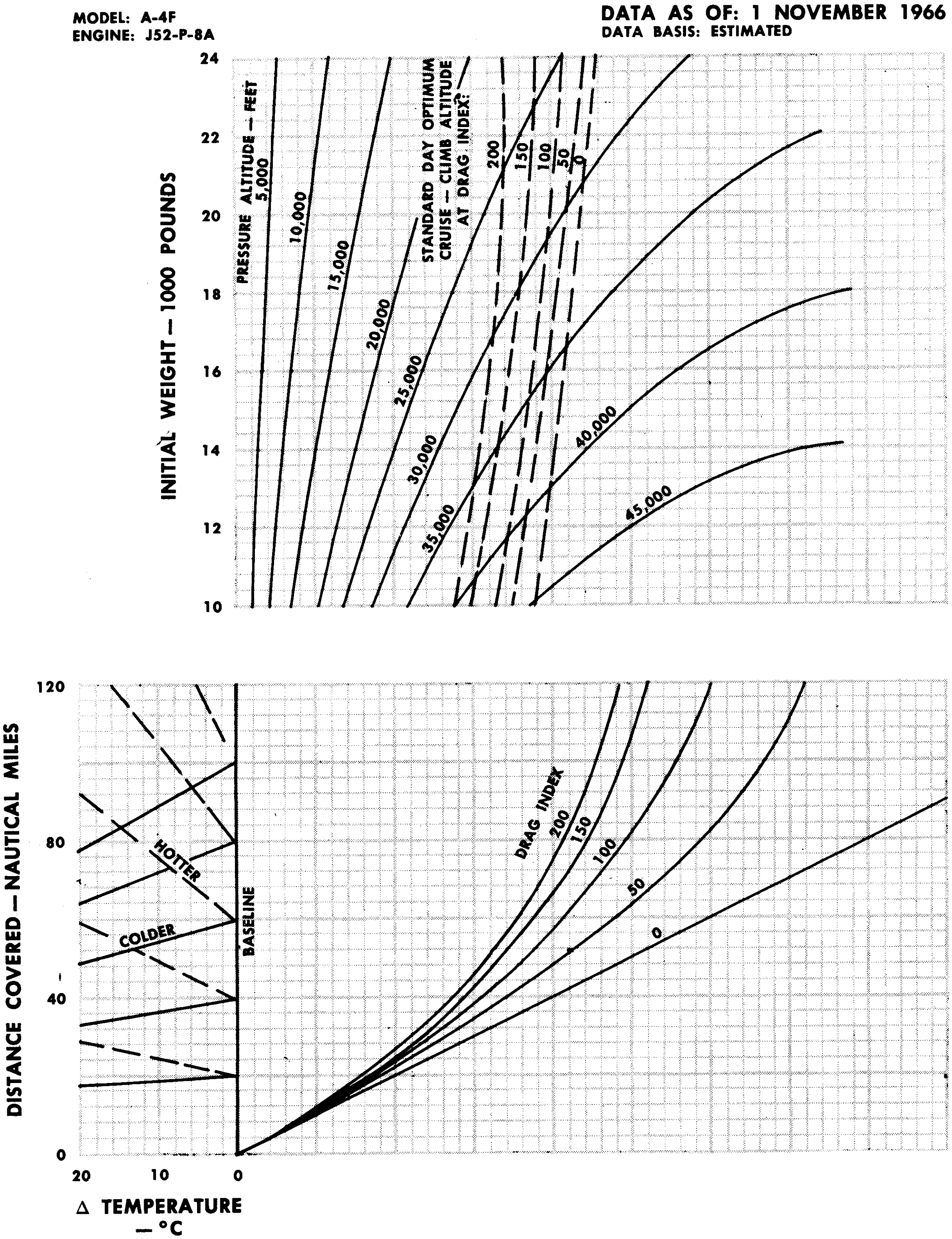
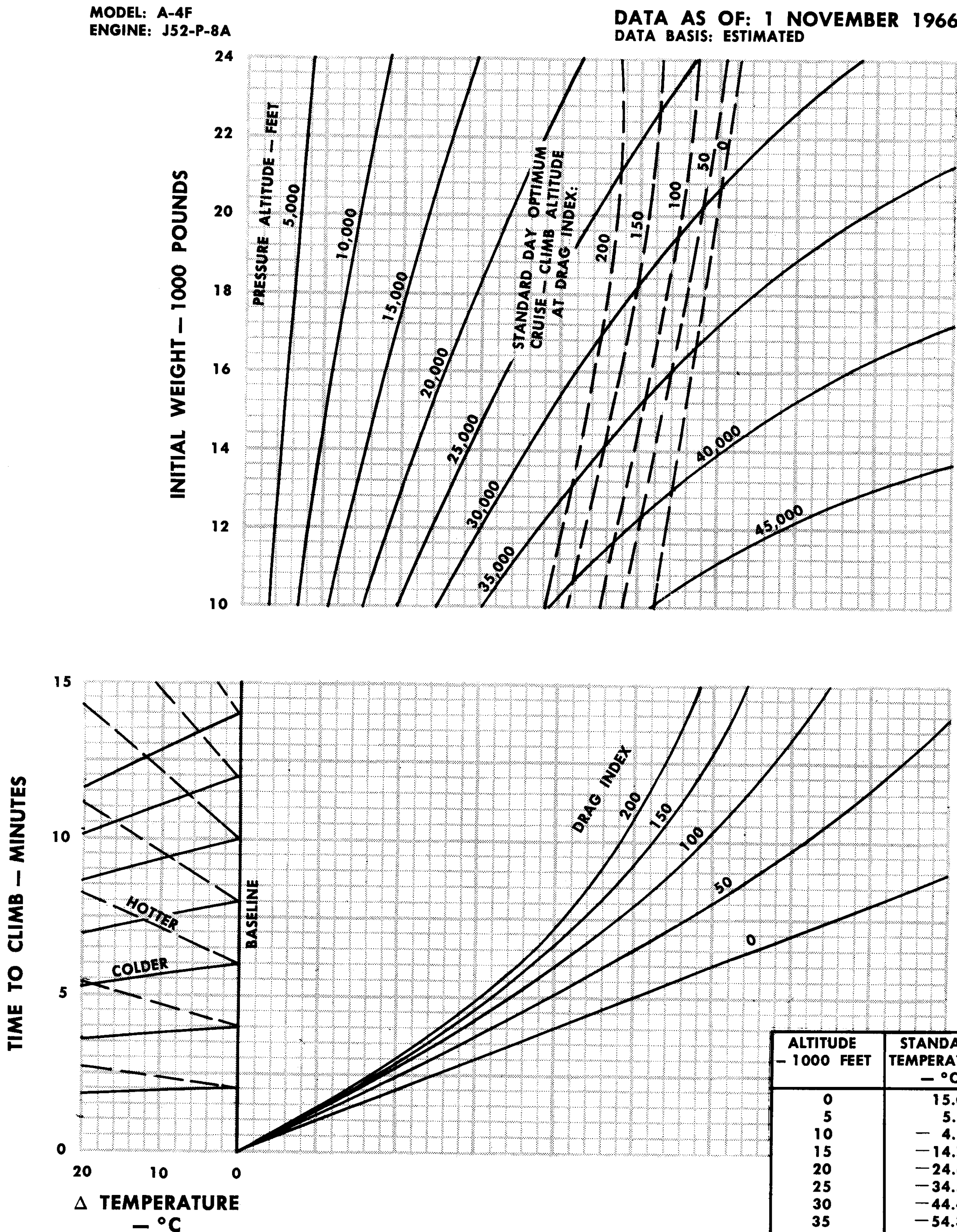


Figure 11-18. Climb Distance

MILITARY THRUST CLIMB
TIME TO CLIMB



ALTITUDE — 1000 FEET	STANDARD TEMPERATURE — °C
0	15.0
5	5.1
10	− 4.8
15	−14.7
20	−24.6
25	−34.5
30	−44.4
35	−54.3
40	−56.5

HH1-157

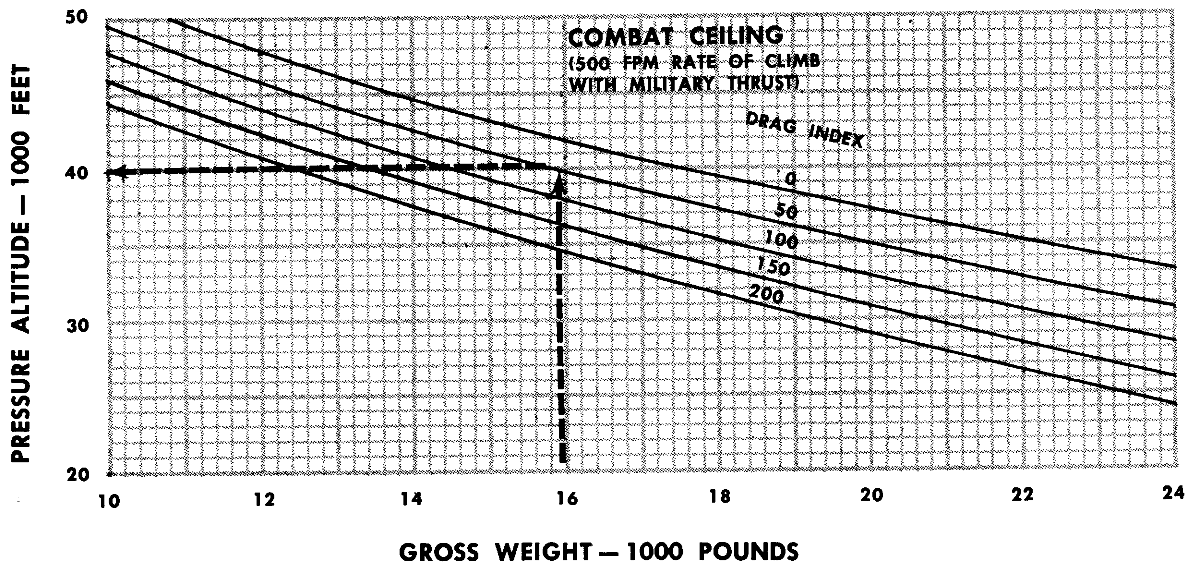
Figure 11-19. Climb Time

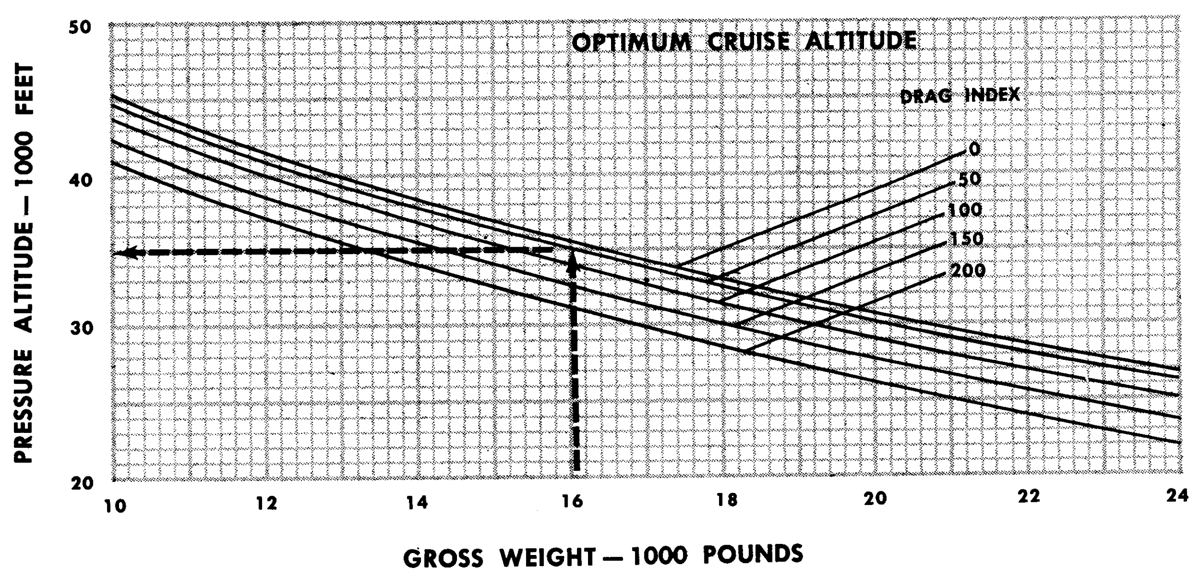
COMBAT CEILING AND OPTIMUM CRUISE ALTITUDE

ICAO STANDARD ATMOSPHERE

MODEL: A-4F
ENGINE: J52-P-8A

DATA AS OF: 1 NOVEMBER 1966
DATA BASIS: ESTIMATED





HH1-158

Figure 11-20. Combat Ceiling and Optimum Cruise Altitude

PART 4
RANGE

Range Factor Chart

The chart (figure 11-21) provides a means of correcting specific (or total) range for existing wind effects. The presented range factors consider wind speeds up to 120 knots from any relative wind direction for aircraft speeds of 350 to 550 KTAS.

USE

Determine the relative wind direction by measuring (in a clockwise direction from the fuselage reference line) the angular difference between the aircraft heading and the true wind direction. At a given wind direction, wind speed, and aircraft true airspeed, read the range factor. Multiply the specific range by this range factor to obtain specific range as affected by wind.

Fouled Deck Range

Occasions arise during carrier operations when the deck becomes fouled and aircraft cannot be taken aboard until the deck is cleared. In these instances, it is desirable for both the pilots and the air officer to be aware of the range capabilities of the unrecovered aircraft in order that an immediate decision can be made concerning the proper course of action. Should the estimated "clear deck" time be beyond the endurance time of the aircraft, then it must either depart immediately for the beach or land aboard the ready deck of another carrier, if available. However, if it is either desirable or mandatory that the aircraft orbit until the deck is clear, it is necessary that the pilot fully understand the proper procedure to obtain the maximum endurance with the available fuel. Fouled Deck Endurance chart is shown in figures 11-29 and 11-68.

The fouled deck range charts (figures 11-22 and 11-61) tabulate the range distances obtainable for various quantities of fuel on board at both the initial altitude and the optimum, best range altitude for the clean configuration plus four empty wing pylons and guns. Climb speeds and airspeeds for maximum range are included in the chart together with letdown instructions.

The time at which letdown should be initiated is given in terms of fuel on board and represents the fuel required to conduct a maximum range descent from altitude described under "If you are at" to sea level. A 250-pound allowance is included for approach and landing. Figures 11-23 and 11-62, Bingo Range, are provided for an aircraft configuration of guns, five pylons, and two 300-gallon external fuel tanks. The procedures for the use of this chart are identical to those for the Fouled Deck Range; however, an 800-pound fuel allowance is included in this chart for approach and landing.

Long Range Cruise

The Long Range Cruise charts are shown in figures 11-24 and 11-63. Long range cruise is defined as the higher Mach number which will result in 99 percent of the maximum miles per pound of fuel. Optimum long range cruise altitude is the altitude that will produce the maximum distance per pound of fuel at the long range cruise condition. Essentially, long range cruise permits an increase of 20 to 30 knots in airspeed for an increase of 1 percent in fuel consumption. To use this chart, average gross weight, cruise altitude, and drag index must be known for a given cruise leg. With these known conditions, long range cruise Mach number, engine power setting in terms of EPR, and specific range (nautical miles per 1000 pounds of fuel) can be determined.

SAMPLE PROBLEM

Long Range Cruise

(For figure 11-24)

(A) Average gross weight . . . . . . 20,000 lb

(B) Cruise altitude . . . . 25,000 ft

(C) Drag index 100

(D) Mach number 0.670

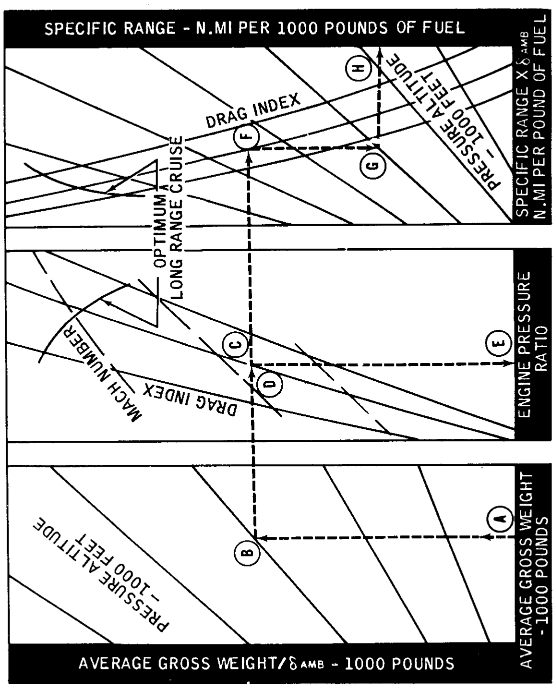
(E) EPR 2.32

(F) Drag Index 100

(G) Cruise altitude . . . . 25,000 ft

(H) Specific range . . . . 148 NMI per 1000 pounds of fuel

SAMPLE LONG RANGE CRUISE



HH1-227

This chart may also be used to determine optimum long range cruise altitude by entering the center plot at the intersection of the optimum long range cruise line and the appropriate drag index, proceeding horizontally to the left until intersecting the vertical line for average aircraft gross weight, and reading the optimum pressure altitude. EPR, Mach number, and specific range can then be determined using the above method.

Maximum Range Cruise

The charts present the necessary mission planning data to set up cruise schedules for a constant or optimum altitude. The average gross weight for a given cruise leg of the mission should be used. The user must know the average gross weight, drag index, cruise altitude, relative wind, and the distance to be covered. It is then possible to determine from the charts true Mach number, true airspeed, time en route, nautical miles per pound, fuel flow, and total fuel required. Optimum cruise altitude (best range) lines are superimposed on the pressure altitude plot. The data is based on maximum range speeds.

SAMPLE PROBLEM

Maximum Range Cruise – Time and Speed

(For figure 11-25)

(A) Average gross weight for cruise leg . . . . 18,000 lb

(B) Cruise altitude . . . . 20,000 ft

(C) Drag index 50

(D) True Mach number 0.608

(E) OAT at cruise altitude . . . . -25°C

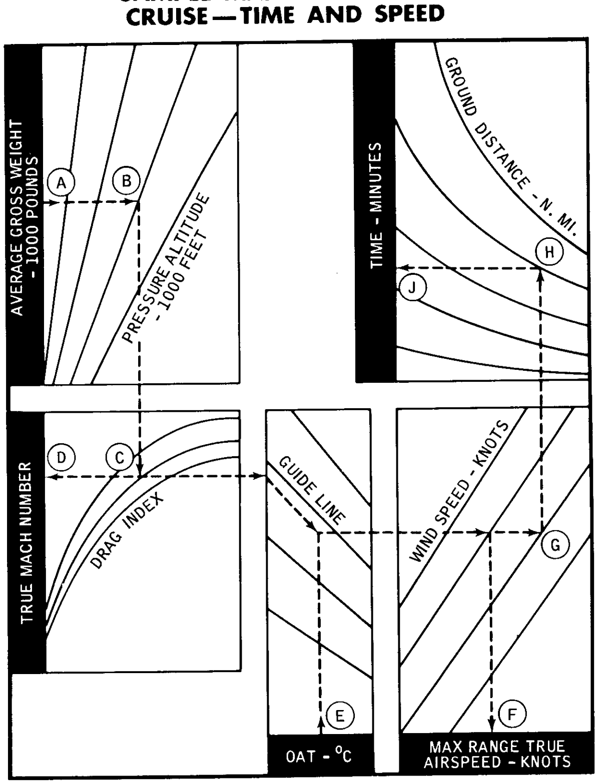
(F) True airspeed. . . . . 374 kn

(G) Tailwind . . . . 50 kn

(H) Ground distance . . . . 150 NMI

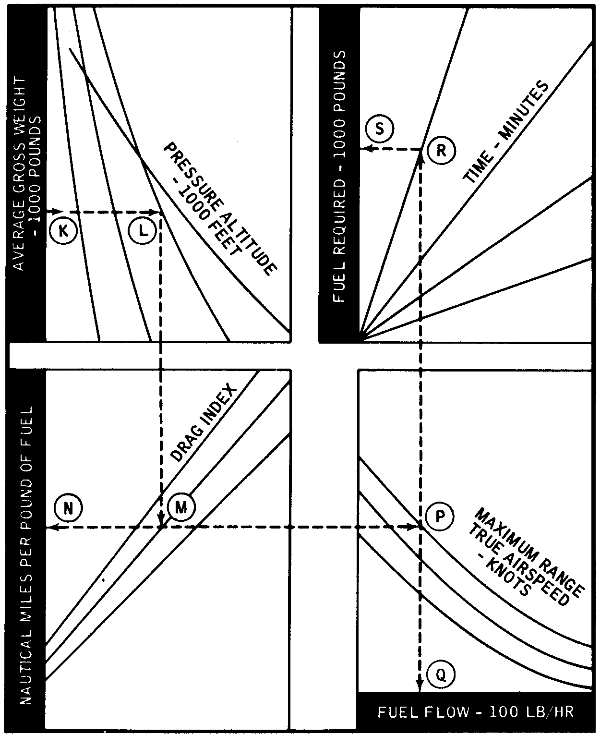
(J) Time . . . . 21.3 min

SAMPLE MAXIMUM RANGE CRUISE—TIME AND SPEED



HH1-159

SAMPLE MAXIMUM RANGE CRUISE—FUEL



HH1-160

Maximum Range Cruise – Fuel

(For figure 11-26)

(K) Average gross weight for cruise leg . . . . 18,000 lb

(L) Cruise altitude . . . . 20,000 ft

(M) Drag index 50

(N) Specific range . . . . 0.168 NMI/lb

(P) True airspeed . . . . 374 kn

(Q) Fuel flow . . . . 2225 lb/hr

(R) Time . . . . 21.3 min

(S) Total fuel required . . . . 790 lb

Nautical Miles Per Pound of Fuel

Nautical miles per pound of fuel charts graphically present cruise data throughout the gross weight, airspeed, and drag index range of the aircraft. By entering the charts with average aircraft gross weight, the cruise altitude, and true Mach number, it is possible to obtain true airspeed, nautical miles per pound, and engine pressure ratio. It is recommended that engine pressure ratio be used as the primary measurement of engine thrust output rather than fuel flow when setting up cruise schedules.

SAMPLE PROBLEM

Nautical Miles per Pound of Fuel

(For figure 11-27, sheet 1)

(A) Average gross weight . . . . 18,000 lb

(B) Cruise altitude . . . . 20,000 ft

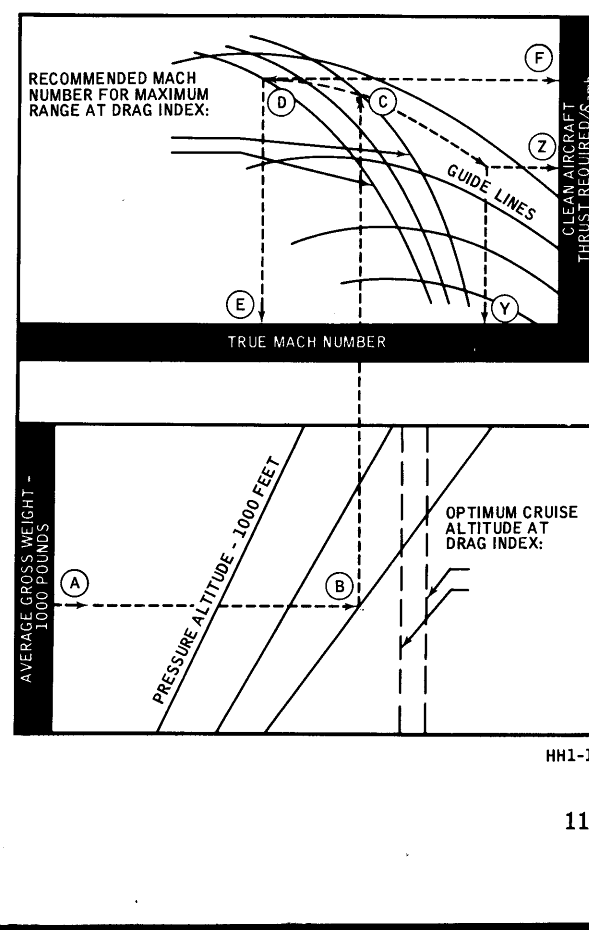
(C) Drag index – 0 line

(D) Drag index 100

(E) Mach number for maximum cruise range 0.578

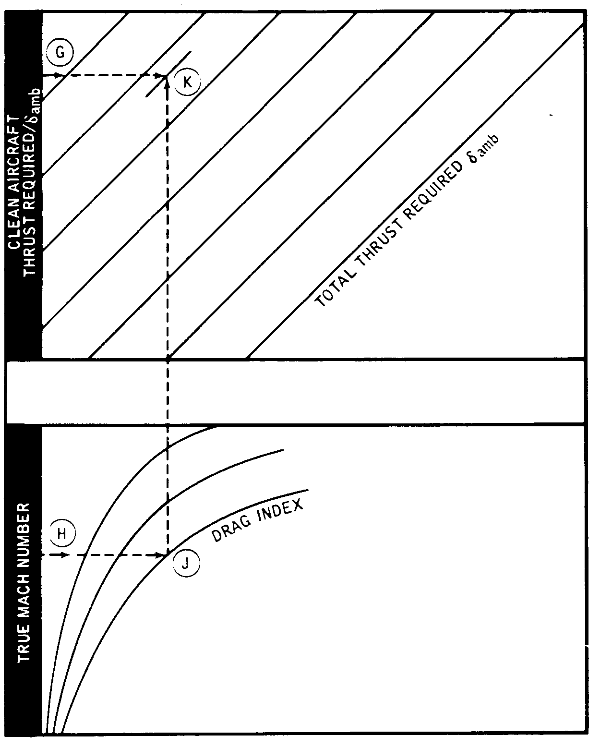
(F) Thrust required /δ amb – Clean A/C . . . . 3900 lb

SAMPLE NAUTICAL MILES PER POUND OF FUEL



HH1-161

SAMPLE NAUTICAL MILES PER POUND OF FUEL



HH1-162

(For figure 11-27, sheet 2)

(G) Thrust required /δ amb – Clean A/C . . . . 3900 lb

(H) Mach number for maximum range cruise 0.578

(J) Drag index 100

(K) Total thrust required/ δ amb . . . . 5200 lb

(For figure 11-27, sheet 3)

(L) Mach number for maximum range cruise 0.578

(M) Total thrust required/ δamb . . . . 5200 lb

(N) Cruise altitude . . . . 20,000 ft

(P) Nautical miles per pound of fuel . . . . 0.151 NMI/lb

(For figure 11-27, sheet 4)

(Q) Nautical miles per pound of fuel . . . . 0.151 NMI/lb

(R) Mach number for maximum range cruise 0.578

(S) OAT at cruise altitude . . . . -20°C

(T) True airspeed . . . . 358 kn

(U) Fuel flow . . . . 2370 lb/hr

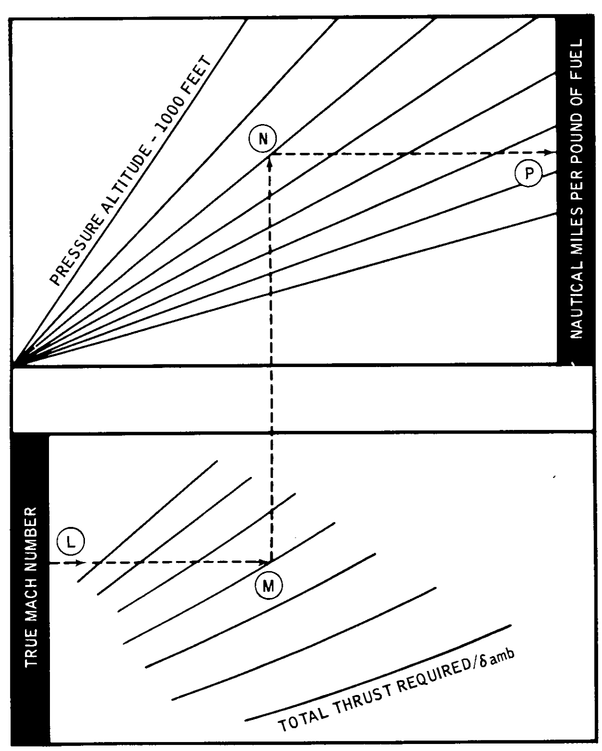
(For figure 11-28)

(V) Total thrust required/ δ amb . . . . 5200 lb

(W) Mach number for maximum range cruise 0.578

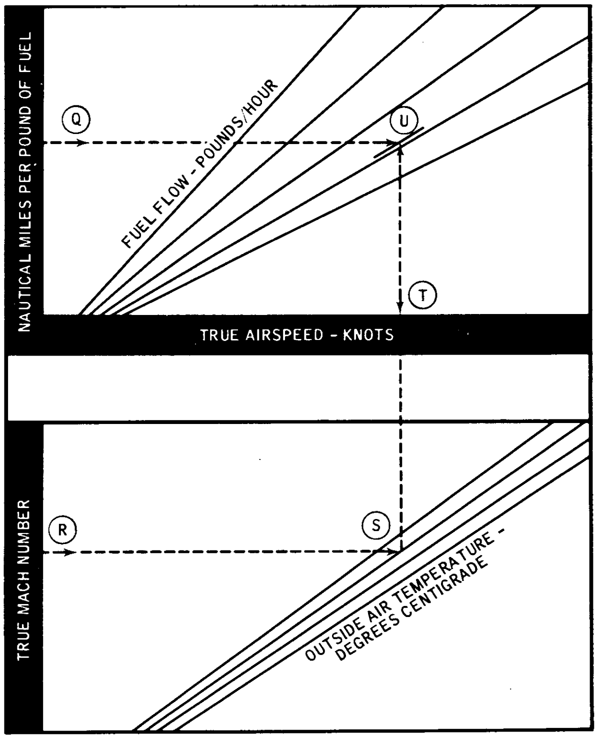
(X) EPR (engine pressure ratio) 1.99

SAMPLE NAUTICAL MILES PER POUND OF FUEL



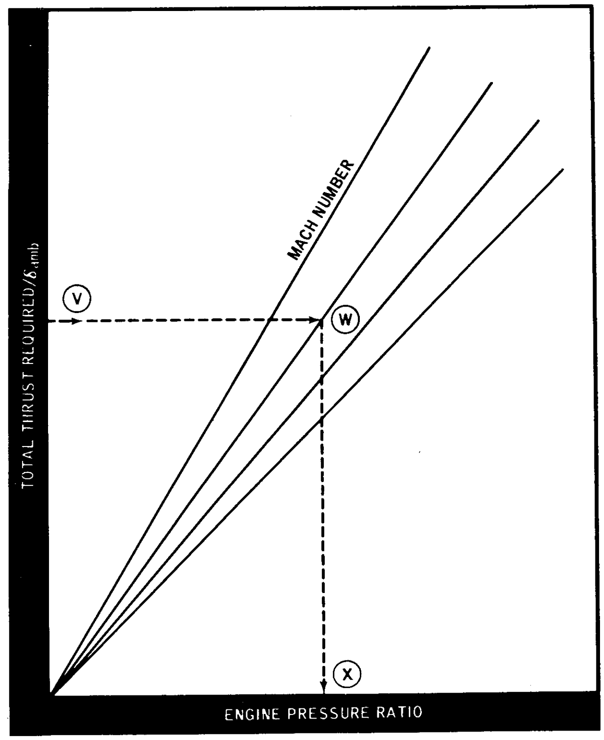
HH1-163

SAMPLE NAUTICAL MILES PER POUND OF FUEL



HH1-164

SAMPLE ENGINE PRESSURE RATIO FOR CRUISE



HH1-165

The previous example was provided for maximum range at a given altitude. In order to assist the user in a more complete understanding of how to use the chart (figure 11-27, sheet 1), an additional example for fixed Mach number cruise is provided.

(For figure 11-27, sheet 1)

(A) Average gross weight . . . . 16,000 lb

(B) Cruise altitude . . . . 25,000 ft

(C) Drag index – 0 line

(Y) Cruise Mach number 0.80

(Z) Thrust required/ δ amb –
Clean A/C . . . . 5750 lb

Relative Wind — Degrees	TAS Knots	Wind Speed — Knots				
		40	60	80	100	120
0° Headwind	350	0.886	0.829	0.772	0.714	0.657
	400	0.900	0.850	0.800	0.750	0.700
	450	0.911	0.867	0.822	0.778	0.733
	500	0.920	0.880	0.844	0.800	0.760
	550	0.927	0.891	0.855	0.818	0.782
30°	350	0.899	0.848	0.796	0.742	0.688
	400	0.912	0.867	0.822	0.776	0.729
	450	0.922	0.882	0.842	0.801	0.760
	500	0.930	0.894	0.858	0.822	0.785
	550	0.936	0.904	0.871	0.839	0.805
60°	350	0.938	0.903	0.866	0.824	0.784
	400	0.946	0.917	0.885	0.852	0.816
	450	0.953	0.927	0.889	0.870	0.840
	500	0.958	0.935	0.910	0.885	0.858
	550	0.962	0.941	0.919	0.897	0.873
90°	350	0.994	0.985	0.974	0.959	0.941
	400	0.995	0.989	0.980	0.969	0.955
	450	0.996	0.991	0.984	0.975	0.964
	500	0.997	0.992	0.987	0.980	0.971
	550	0.997	0.994	0.989	0.984	0.976
120°	350	1.062	1.097	1.134	1.176	1.216
	400	1.054	1.083	1.115	1.148	1.184
	450	1.047	1.073	1.101	1.130	1.160
	500	1.042	1.065	1.090	1.115	1.142
	550	1.038	1.059	1.081	1.103	1.127
150°	350	1.101	1.152	1.205	1.258	1.312
	400	1.088	1.133	1.178	1.224	1.271
	450	1.078	1.118	1.158	1.199	1.240
	500	1.070	1.106	1.142	1.178	1.215
	550	1.064	1.096	1.129	1.162	1.195
180° Tailwind	350	1.114	1.172	1.228	1.286	1.343
	400	1.100	1.150	1.200	1.250	1.300
	450	1.089	1.133	1.178	1.222	1.267
	500	1.080	1.120	1.160	1.200	1.240
	550	1.073	1.109	1.146	1.182	1.218

Figure 11-21. Range Factor Chart

FOULED DECK RANGE

Drag Index = 40
Aircraft Weight (Less Fuel) = 11, 845 Pounds
Five Pylons and Guns
Reserve Fuel For Landing = 250 Pounds

Model: A-4F
Engine: J52-P-8A

Data as of: 15 September 1967
Data Basis: Estimated

FUEL ON BOARD – POUNDS	IF YOU ARE AT SEA LEVEL				IF YOU ARE AT 10, 000 FEET				IF YOU ARE AT 20, 000 FEET			
	Range At Sea Level	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 10, 000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 20, 000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude
	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots
2300	234	40, 000	509	215	319	40, 000	535	215	423	40, 000	561	215
1900	189	40, 000	405	215	259	40, 000	432	215	344	40, 000	456	215
1700	167	40, 000	350	215	229	40, 000	378	215	305	40, 000	402	215
1500	144	40, 000	296	215	199	40, 000	323	215	366	40, 000	348	215
1300	121	40, 000	240	215	169	40, 000	267	215	226	40, 000	292	215
1100	98	40, 000	183	210	138	40, 000	210	210	186	40, 000	236	210
900	75	35, 000	127	220	108	40, 000	153	210	146	40, 000	178	210
700	52	25, 000	75	230	77	25, 000	95	230	106	35, 000	121	210
500	29	15, 000	36	245	46	15, 000	49	245	65	25, 000	67	220

FUEL ON BOARD – POUNDS	IF YOU ARE AT 30, 000 FEET				IF YOU ARE AT 35, 000 FEET				IF YOU ARE AT 40, 000 FEET			
	Range At 30,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 35, 000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 40, 000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude
	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots
2300	537	40, 000	583	215	579	40, 000	591	215	601	40, 000	601	215
1900	440	40, 000	479	215	475	40, 000	488	215	496	40, 000	496	215
1700	390	40, 000	425	215	423	40, 000	434	215	430	40, 000	430	215
1500	340	40, 000	370	215	370	40, 000	379	215	377	40, 000	377	215
1300	290	40, 000	316	215	316	40, 000	324	215	324	40, 000	324	215
1100	240	40, 000	259	215	262	40, 000	267	215	270	40, 000	270	215
900	189	40, 000	202	210	206	40, 000	211	210	215	40, 000	215	210
700	137	40, 000	144	210	148	40, 000	153	210	159	40, 000	159	210
500	85	35, 000	87	220	93	35, 000	93	220	102	40, 000	102	210

Pressure Altitude	Climb Speed Military Thrust		Descent Speed Engine Idle – Speedbrakes Closed	Start Letdown From Altitude With Fuel Remaining
Feet	KCAS	Mach No.	KCAS	Pounds
Sea Level	350		180	250
10, 000	335		185	310
20, 000	320		185	350
30, 000		0.76	185	375
35, 000		0.76	185	390
40, 000		0.76	185	400

Figure 11-22. Fouled Deck Range

BINGO RANGE

Drag Index = 67
Aircraft Weight (Less Fuel) = 12,242 Pounds
Five Pylons, Guns, and Two 300 Gallon External Tanks
Reserve Fuel Allowance For Landing = 800 Pounds

Model: A-4F
Engine: J52-P-8A

Data as of: 15 September 1967
Data Basis: Estimated

FUEL ON BOARD – POUNDS	IF YOU ARE AT SEA LEVEL				IF YOU ARE AT 10,000 FEET				IF YOU ARE AT 20,000 FEET			
	Range At Sea Level	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 10,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 20,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude
	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots
2700	203	40,000	405	215	275	40,000	430	215	362	40,000	454	215
2500	182	40,000	360	215	248	40,000	385	215	326	40,000	410	215
2300	161	40,000	313	215	220	40,000	338	215	290	40,000	363	215
2100	140	40,000	266	215	192	40,000	292	215	254	40,000	316	215
1900	119	40,000	218	215	164	40,000	244	215	218	40,000	269	215
1700	97	35,000	171	225	136	35,000	195	220	181	40,000	220	215
1500	76	35,000	122	225	108	35,000	147	220	145	40,000	171	215
1300	54	25,000	77	235	79	35,000	98	220	108	35,000	122	220
1100	33	15,000	41	240	51	20,000	55	240	71	25,000	74	235

FUEL ON BOARD – POUNDS	IF YOU ARE AT 30,000 FEET				IF YOU ARE AT 35,000 FEET				IF YOU ARE AT 40,000 FEET			
	Range At 30,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 35,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 40,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude
	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots
2700	450	40,000	476	215	481	40,000	484	215	492	40,000	492	215
2500	407	40,000	431	215	412	40,000	439	215	447	40,000	447	215
2300	363	40,000	384	215	390	40,000	392	215	401	40,000	401	215
2100	319	40,000	338	215	343	40,000	346	215	355	40,000	355	215
1900	275	40,000	291	215	296	40,000	299	215	307	40,000	307	215
1700	229	40,000	242	215	248	40,000	250	215	259	40,000	259	215
1500	184	40,000	193	215	200	40,000	201	215	210	40,000	210	215
1300	138	35,000	143	220	151	40,000	151	215	160	40,000	160	215
1100	92	35,000	94	220	102	35,000	102	220	110	40,000	110	215

Pressure Altitude	Climb Speed Military Thrust		Descent Speed Engine Idle – Speedbrakes Closed	Start Letdown From Altitude With Fuel Remaining
Feet	KCAS	Mach No.	KCAS	Pounds
Sea Level	335		190	800
10,000	320		190	860
20,000	305	.	190	890
30,000		0.74	190	915
35,000		0.74	190	930
40,000		0.74	190	940

Figure 11-23. Bingo Range

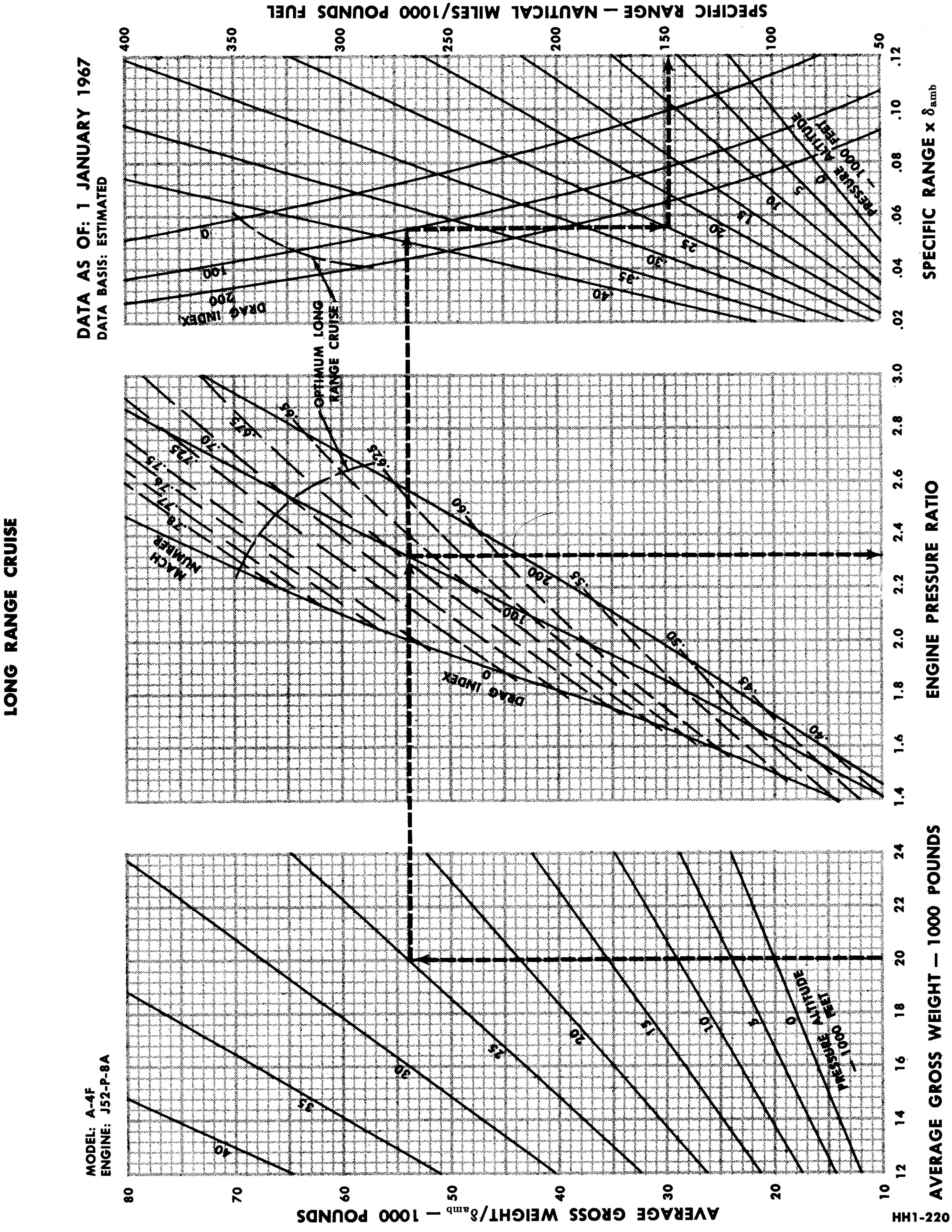


Figure 11-24. Long Range Cruise

MAXIMUM RANGE CRUISE
TIME AND SPEED

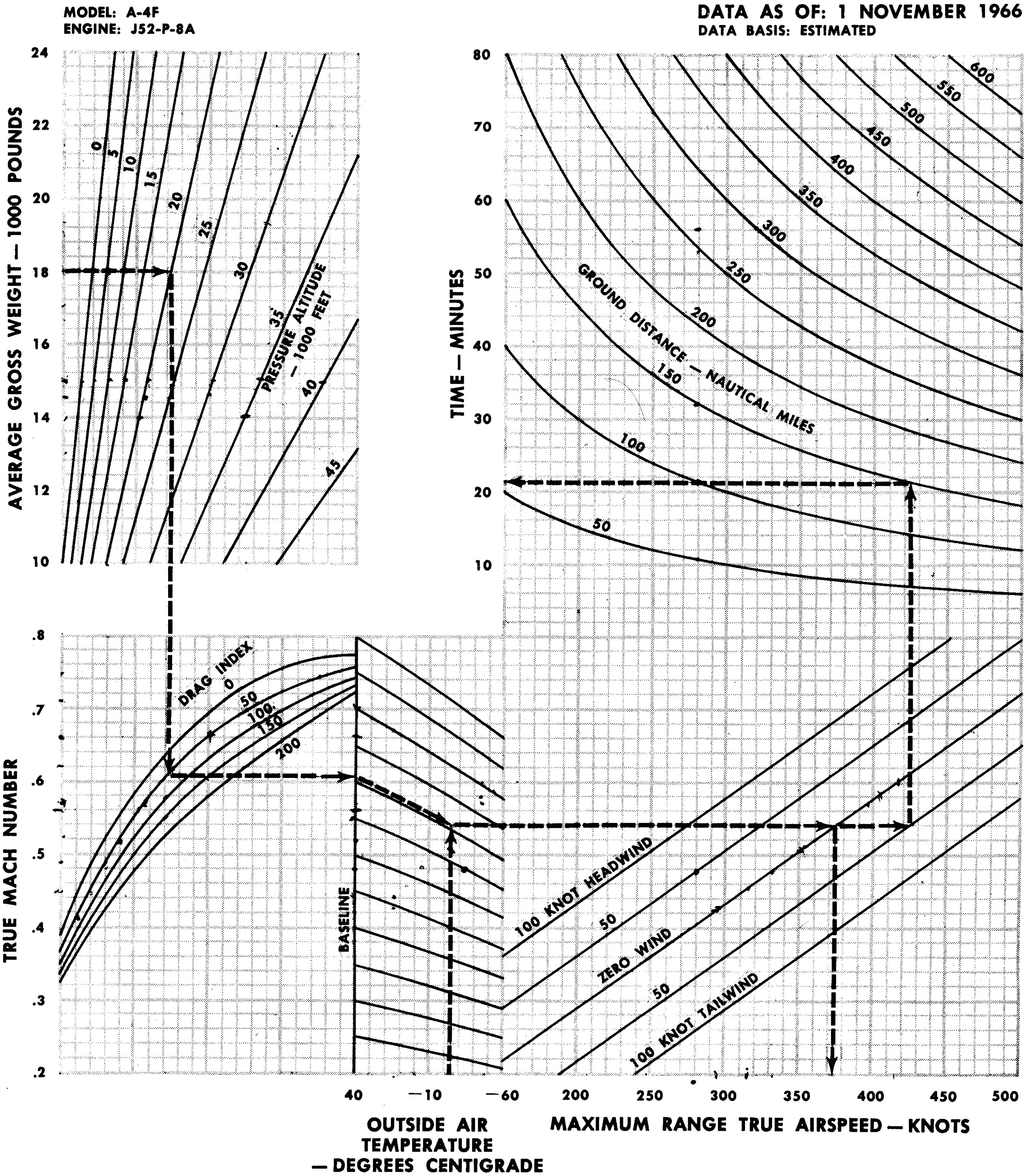


Figure 11-25. Maximum Range Cruise — Time and Speed

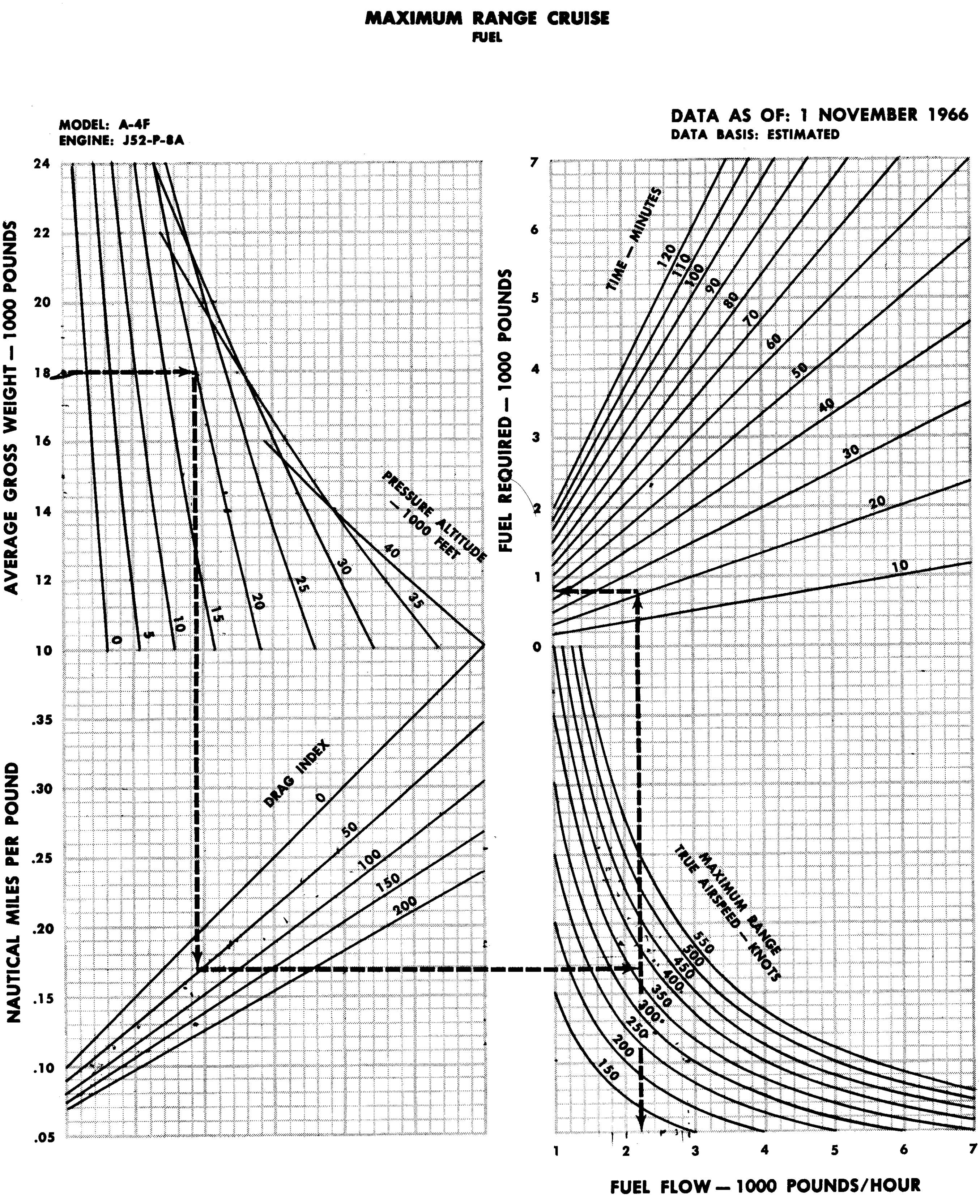


Figure 11-26. Maximum Range Cruise — Fuel

NAUTICAL MILES PER POUND OF FUEL

MODEL: A-4F
ENGINE: J52-P-8A

DATA AS OF: 1 NOVEMBER 1966
DATA BASIS: ESTIMATED

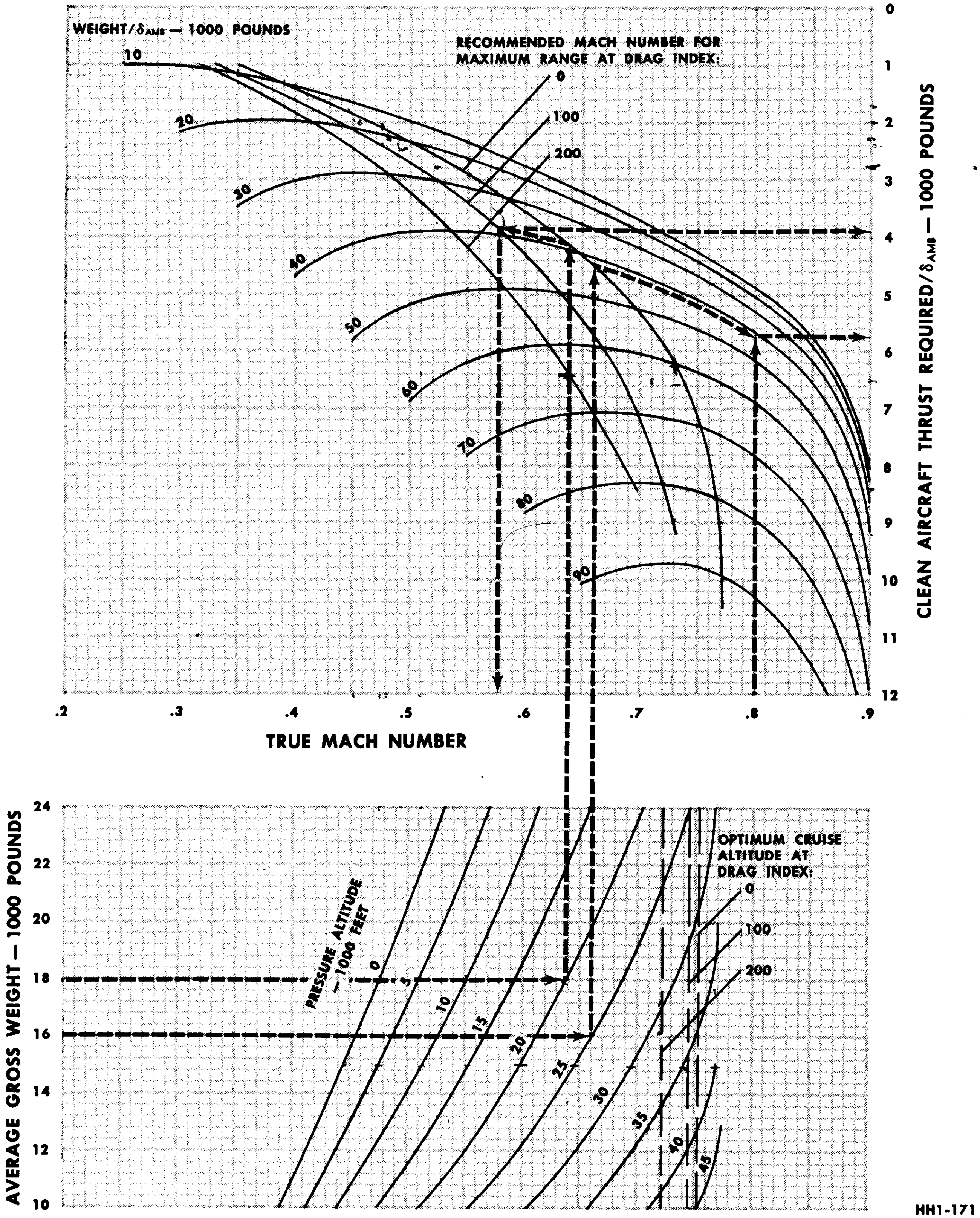


Figure 11-27. Nautical Miles per Pound of Fuel (Sheet 1)

NAUTICAL MILES PER POUND OF FUEL

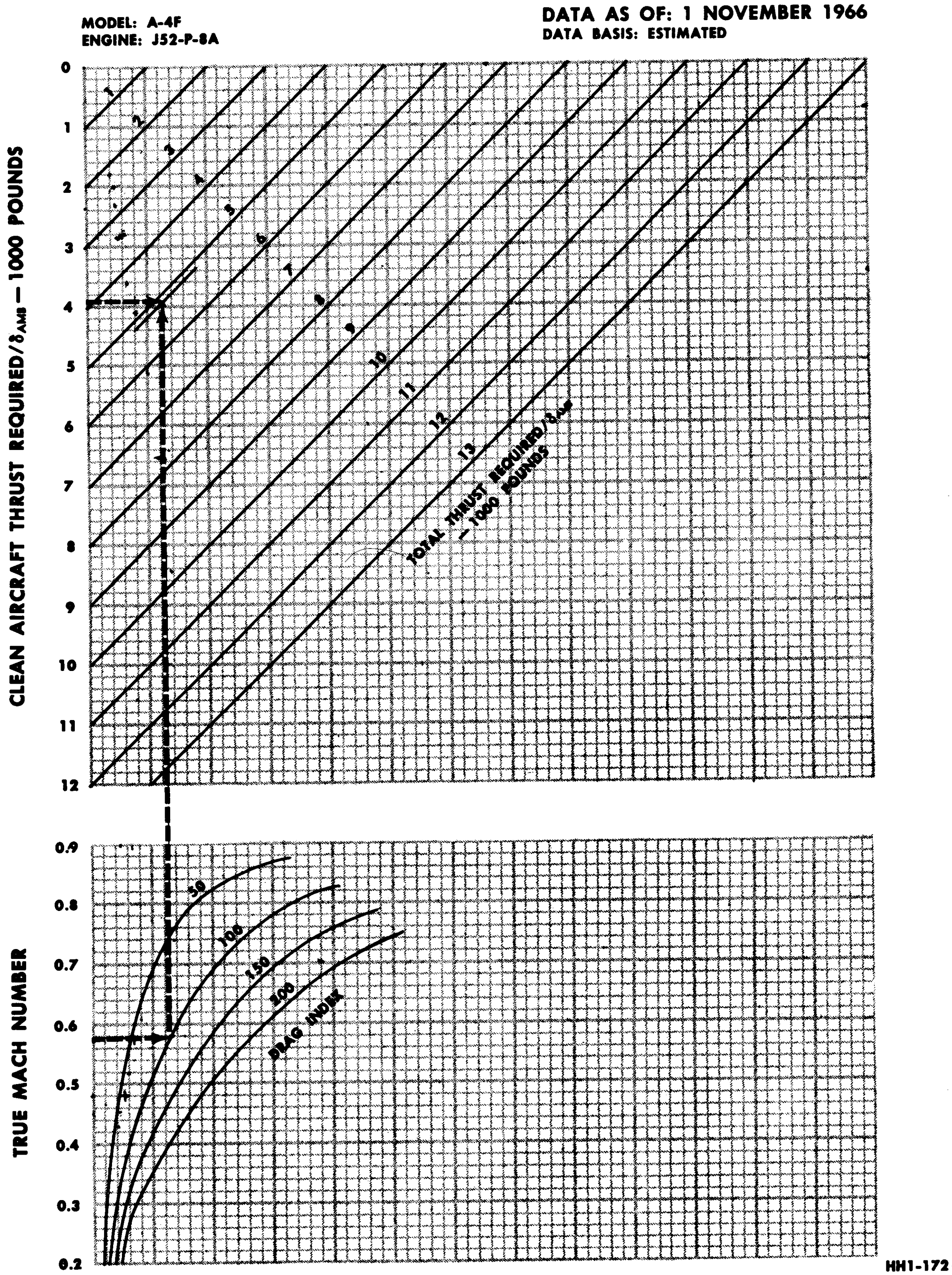


Figure 11-27. Nautical Miles per Pound of Fuel (Sheet 2)

NAUTICAL MILES PER POUND OF FUEL

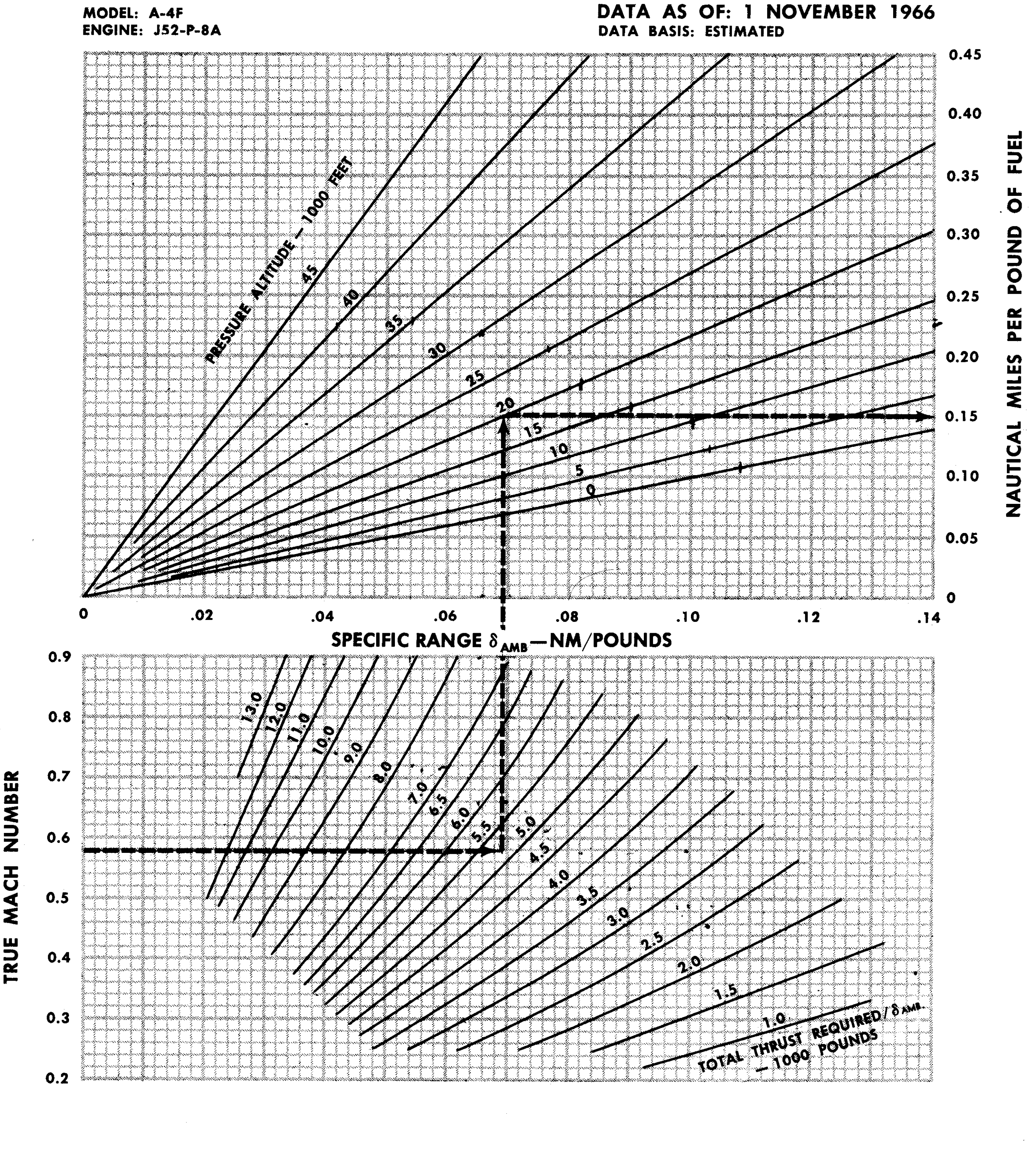


Figure 11-27. Nautical Miles per Pound of Fuel (Sheet 3)

NAUTICAL MILES PER POUND OF FUEL

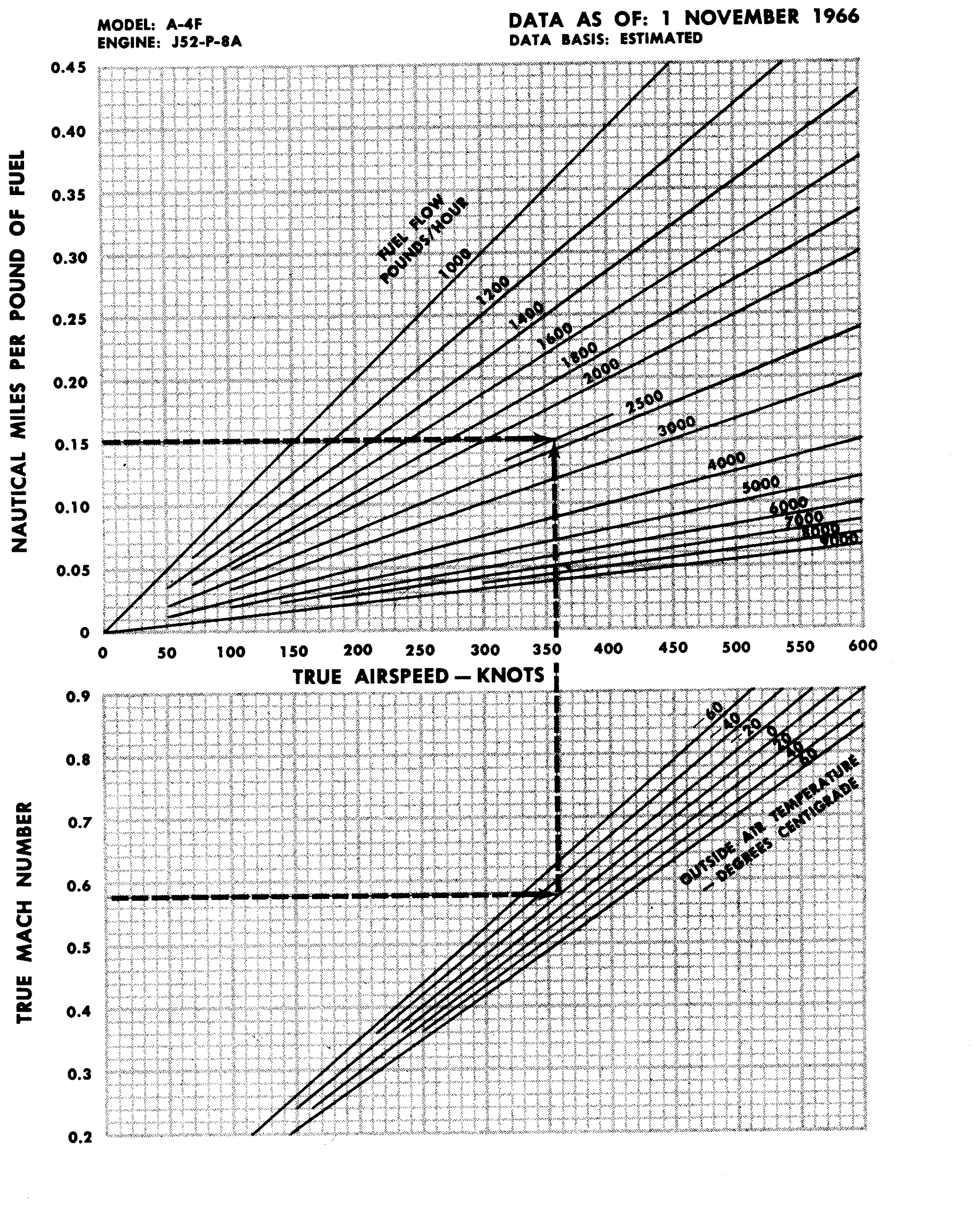


Figure 11-27. Nautical Miles per Pound of Fuel (Sheet 4)

ENGINE PRESSURE RATIO FOR CRUISE

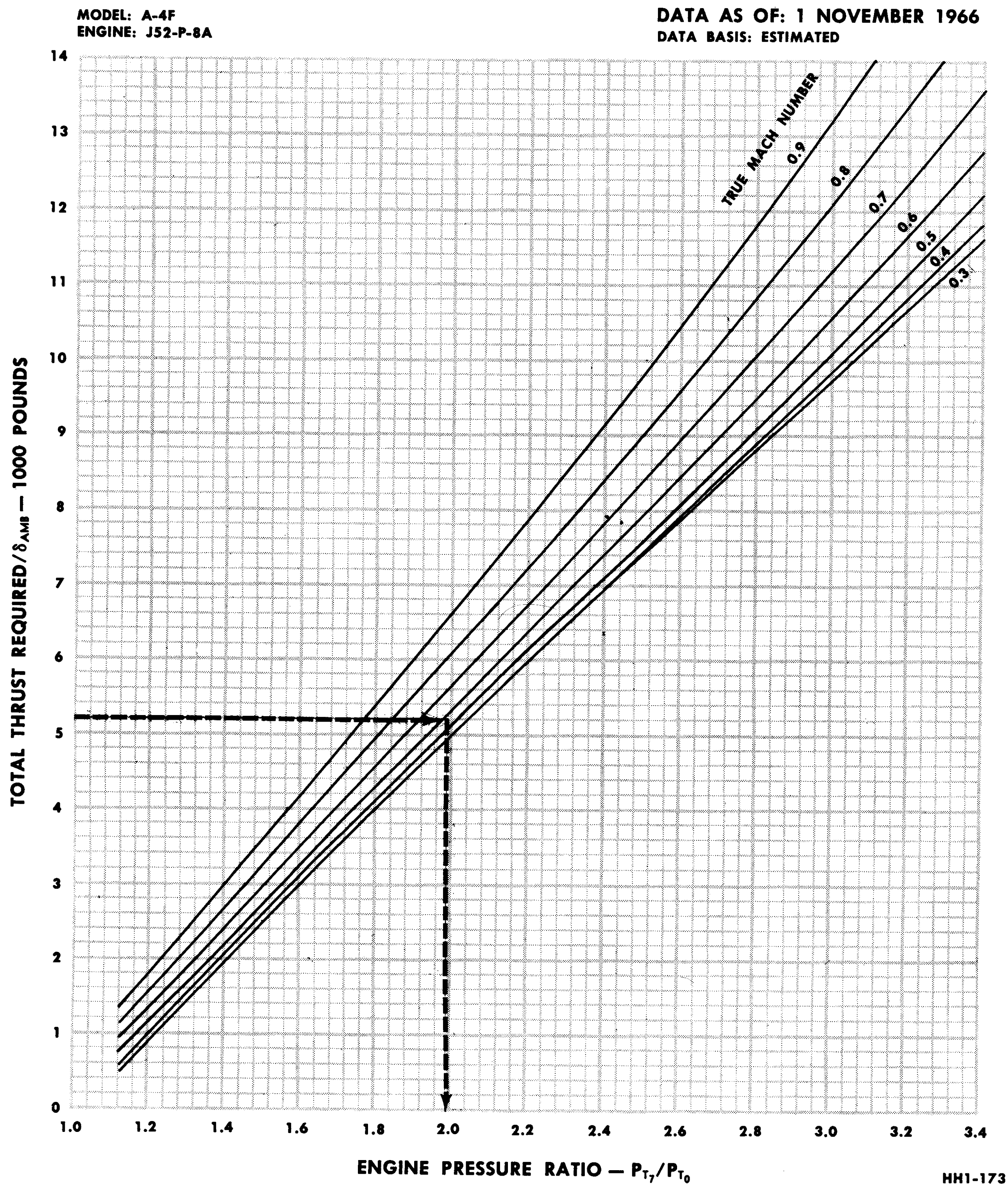


Figure 11-28. Engine Pressure Ratio for Cruise

PART 5
ENDURANCE

Fouled Deck Endurance

Occasions arise during carrier operations when the deck becomes fouled and aircraft cannot be taken aboard until the deck is cleared. In these instances, it is desirable for the pilots and the air officer to be aware of the endurance capabilities of the unrecovered aircraft so that an immediate decision can be made concerning the proper course of action. Should the estimated "clear deck" time be beyond the endurance time of the aircraft, then it must either depart immediately for the beach, or land aboard the ready deck of another carrier, if available. However, if it is either desirable or mandatory that the aircraft orbit until the deck is clear, it is necessary that the pilot fully understand the proper procedure to obtain the maximum endurance with the available fuel. The fouled deck endurance charts (figures 11-29 and 11-68) tabulate the endurance times for various quantities of fuel on board at both the initial altitude and the optimum altitude for an aircraft configured with five pylons and guns. The endurance values are given in minutes and, for the optimum altitudes, include the time required for a military climb to that altitude and a maximum range descent to sea level with 250 pounds of fuel remaining for approach and landing. The endurance times for the initial altitude naturally include only the descent time as no climb is required. Climbing airspeeds and recommended airspeeds for maximum endurance are included on the chart together with descent instructions.

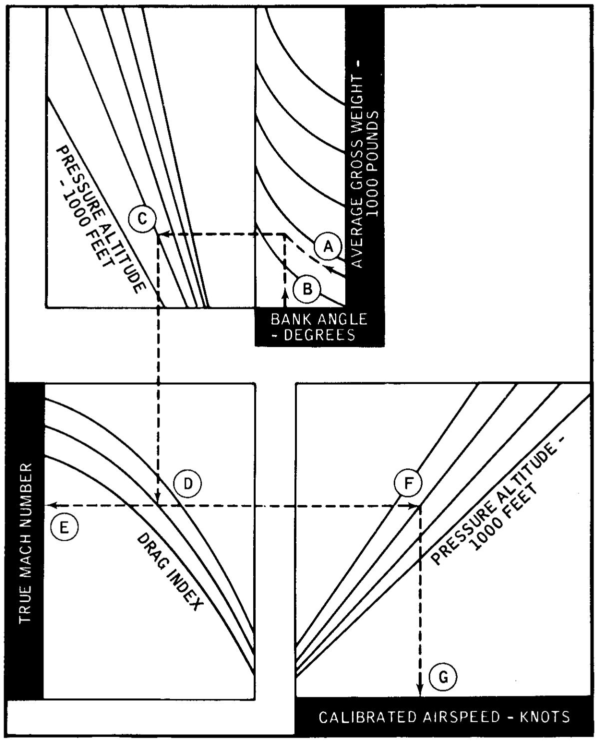
The time at which the descent should be started is given in terms of fuel on board, which includes the 250 pounds necessary for landing.

Figures 11-30 and 11-69, Bingo Endurance are provided for an aircraft configuration of guns, five pylons, and two 300-gallon external fuel tanks. The procedures for the use of the charts are identical to those for fouled deck endurance; however, an 800-pound fuel allowance is included in this chart for approach and landing.

Maximum Endurance

The endurance chart provides a means of determining the optimum endurance Mach number and the fuel required to loiter at a given altitude for a specified length of time. The optimum Mach number is shown as a function of average gross weight, bank angle, pressure altitude, and drag index. Fuel required is presented as a function of average gross weight, bank angle, pressure altitude, loiter time, and drag index.

SAMPLE MAXIMUM ENDURANCE SPEED



HH1-174

SAMPLE PROBLEM

Maximum Endurance Speed

(For figure 11-31)

(A) Average gross weight . . . . 17,000 lb

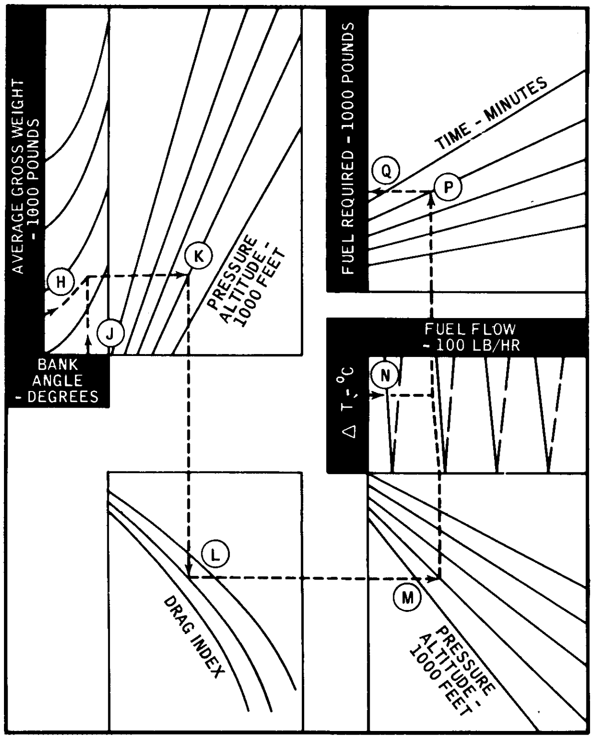
(B) Bank angle . . . . 15 degrees

(C) Loiter Altitude . . . . 10,000 ft

(D) Drag index 100

(E) Optimum Mach number 0.375

SAMPLE MAXIMUM ENDURANCE FUEL



HH1-176

(F) Loiter altitude. . . . . 10,000 ft

(G) Loiter airspeed . . . . 210 KCAS

SAMPLE PROBLEM

Maximum Endurance Fuel

(For figure 11-32)

(H) Average gross weight . . . . 17,000 lb

(J) Bank angle . . . . 15 degrees

(K) Loiter altitude . . . . 10,000 ft

(L) Drag index 100

(M) Loiter altitude . . . . 10,000 ft

(N) Temperature deviation from standard day . . . . +10°C

(P) Loiter time . . . . 30 min

(Q) Fuel required . . . . 1100 lb

FOULED DECK ENDURANCE

Drag Index = 40
Aircraft Weight (Less Fuel) = 11, 845 Pounds
Five Pylons and Guns
Reserve Fuel For Landing = 250 Pounds

Model: A-4F
Engine: J52-P-8A

Data as of: 15 September 1967
Data Basis: Estimated

FUEL ON BOARD – POUNDS	IF YOU ARE AT SEA LEVEL				IF YOU ARE AT 10,000 FEET				IF YOU ARE AT 20,000 FEET			
	Endurance At Sea Level	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 10,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 20,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude
	Minutes	Feet	Minutes	Knots	Minutes	Feet	Minutes	Knots	Minutes	Feet	Minutes	Knots
2300	64	35,000	89	195	78	35,000	93	195	91	35,000	97	195
1900	52	35,000	72	195	64	35,000	76	195	75	35,000	80	195
1700	46	35,000	63	190	57	35,000	67	195	67	35,000	71	195
1500	40	35,000	54	190	50	35,000	58	190	59	35,000	62	190
1300	33	35,000	45	190	42	35,000	49	190	51	35,000	53	190
1100	27	35,000	36	190	35	35,000	40	190	42	35,000	44	190
900	21	30,000	26	190	28	30,000	31	190	34	30,000	35	190
700	15	20,000	18	185	20	25,000	21	185	25	30,000	25	185
500	8	10,000	9	185	12	15,000	13	185	16	20,000	16	185

FUEL ON BOARD – POUNDS	IF YOU ARE AT 30,000 FEET				IF YOU ARE AT 35,000 FEET				IF YOU ARE AT 40,000 FEET			
	Endurance At 30,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 35,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 40,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude
	Minutes	Feet	Minutes	Knots	Minutes	Feet	Minutes	Knots	Minutes	Feet	Minutes	Knots
2300	101	35,000	101	195	103	35,000	103	195	99	35,000	104	195
1900	84	35,000	84	195	86	35,000	86	195	83	35,000	87	195
1700	75	35,000	75	195	77	35,000	77	195	75	35,000	79	195
1500	66	35,000	66	190	68	35,000	68	195	67	35,000	70	195
1300	57	35,000	57	190	59	35,000	59	190	58	35,000	60	190
1100	48	35,000	48	190	50	35,000	50	190	50	35,000	51	190
900	39	35,000	39	190	40	35,000	40	190	41	35,000	42	190
700	29	35,000	29	190	31	35,000	31	190	32	35,000	32	190
500	20	30,000	19	190	21	35,000	21	190	22	35,000	22	190

Pressure Altitude	Climb Speed Military Thrust		Descent Speed Engine Idle – Speedbrakes Closed	Start Letdown From Altitude With Fuel Remaining
Feet	KCAS	Mach No.	KCAS	Pounds
Sea Level	350		180	250
10,000	335		185	310
20,000	320		185	350
30,000		0.76	185	375
35,000		0.76	185	390
40,000		0.76	185	400

Figure 11-29. Fouled Deck Endurance

BINGO ENDURANCE

Drag Index = 67
Aircraft Weight (Less Fuel) = 12,242 Pounds
Five Pylons, Guns, and Two 300 Gallon External Tanks
Reserve Fuel Allowance For Landing = 800 Pounds

Model: A-4F
Engine: J52-P-8A

Data as of: 15 September 1967
Data Basis: Estimated

FUEL ON BOARD – POUNDS	IF YOU ARE AT SEA LEVEL				IF YOU ARE AT 10,000 FEET				IF YOU ARE AT 20,000 FEET			
	Endurance At Sea Level	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 10,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 20,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude
	Minutes	Feet	Minutes	Knots	Minutes	Feet	Minutes	Knots	Minutes	Feet	Minutes	Knots
2700	55	30,000	73	195	67	30,000	77	195	77	30,000	81	195
2500	50	30,000	65	195	61	30,000	69	195	70	30,000	73	195
2300	44	30,000	57	195	54	30,000	61	195	63	30,000	66	195
2100	38	30,000	49	195	48	30,000	54	195	56	30,000	58	195
1900	33	30,000	41	195	41	30,000	46	195	48	30,000	50	195
1700	27	25,000	33	190	34	30,000	37	195	41	30,000	42	195
1500	21	25,000	25	190	27	30,000	29	195	33	30,000	33	195
1300	15	20,000	18	190	20	20,000	21	190	25	20,000	25	190
1100	9	10,000	10	190	13	15,000	14	190	17	20,000	17	190

FUEL ON BOARD – POUNDS	IF YOU ARE AT 30,000 FEET				IF YOU ARE AT 35,000 FEET				IF YOU ARE AT 40,000 FEET			
	Endurance At 30,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 35,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 40,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude
	Minutes	Feet	Minutes	Knots	Minutes	Feet	Minutes	Knots	Minutes	Feet	Minutes	Knots
2700	85	30,000	85	195	85	35,000	85	195	81	35,000	87	195
2500	77	30,000	77	195	78	35,000	78	195	74	35,000	79	195
2300	69	30,000	69	195	70	35,000	70	195	67	35,000	71	195
2100	62	30,000	62	195	62	35,000	62	195	60	35,000	64	195
1900	54	30,000	54	195	55	35,000	55	195	53	35,000	56	195
1700	46	30,000	46	195	47	35,000	47	195	46	35,000	48	195
1500	37	30,000	37	195	39	35,000	39	190	38	35,000	40	190
1300	29	30,000	29	190	30	35,000	30	190	30	35,000	31	190
1100	21	30,000	21	190	22	35,000	22	190	23	35,000	23	190

Pressure Altitude	Climb Speed Military Thrust		Descent Speed Engine Idle – Speedbrakes Closed	Start Letdown From Altitude With Fuel Remaining
Feet	KCAS	Mach No.	KCAS	Pounds
Sea Level	335		190	800
10,000	320		190	860
20,000	305		190	890
30,000		0.74	190	915
35,000		0.74	190	930
40,000		0.74	190	940

Figure 11-30. Bingo Endurance

MAXIMUM ENDURANCE SPEED

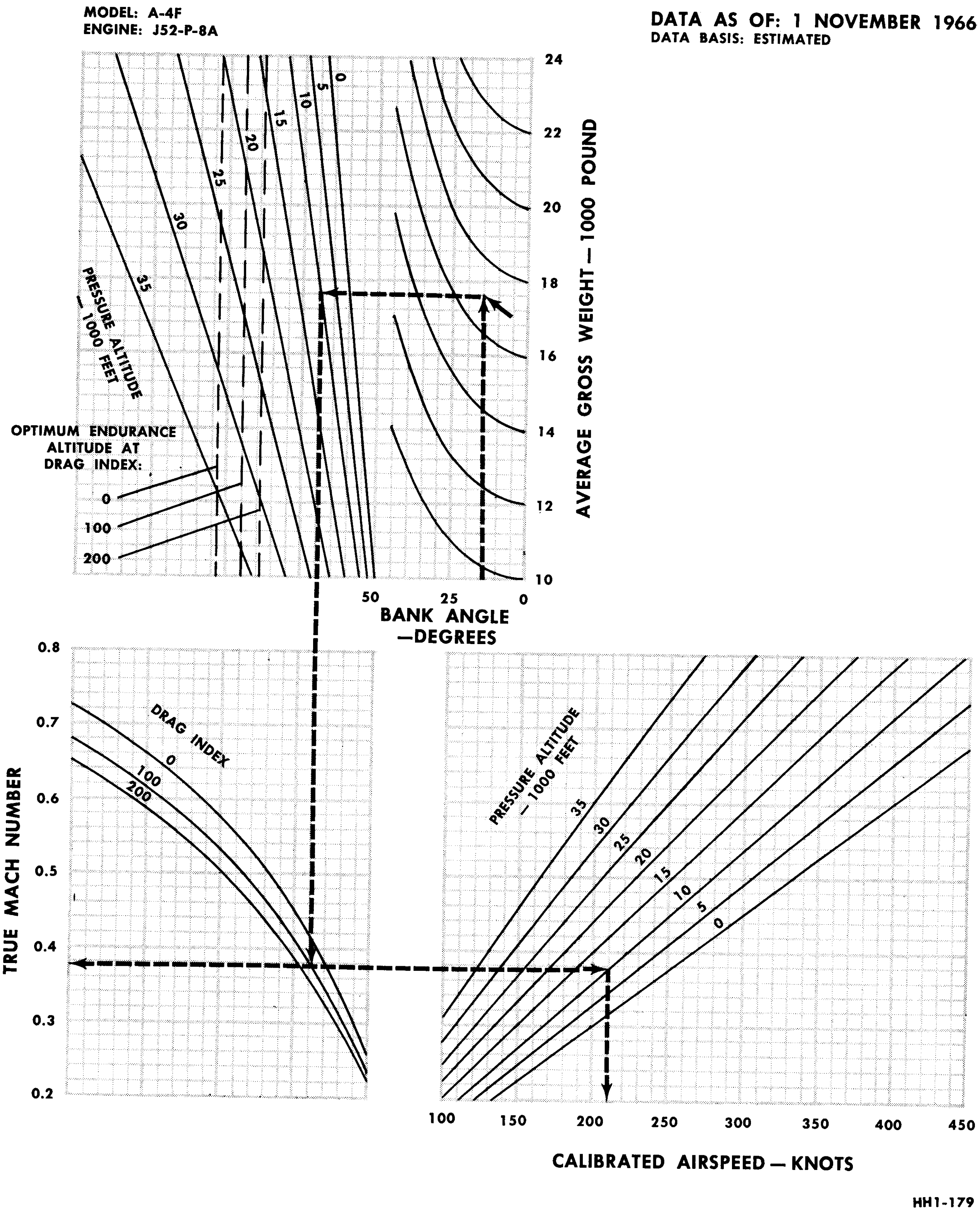
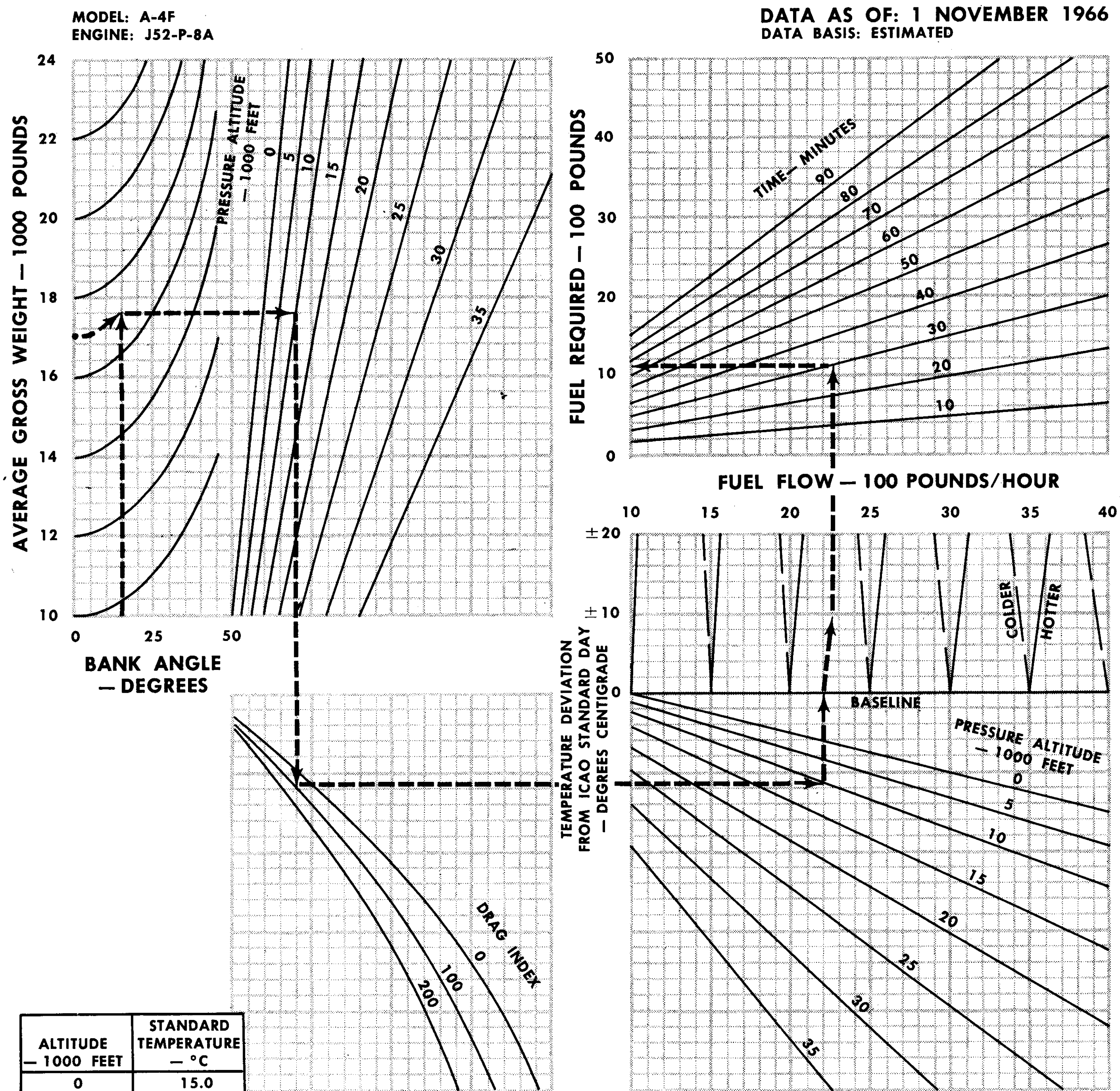


Figure 11-31. Maximum Endurance Speed

MAXIMUM ENDURANCE FUEL



ALTITUDE — 1000 FEET	STANDARD TEMPERATURE — °C
0	15.0
5	5.1
10	— 4.8
15	—14.7
20	—24.6
25	—34.5
30	—44.4
35	—54.3

Figure 11-32. Maximum Endurance Fuel

PART 6
AIR REFUELING

Air Refueling Charts

The air refueling charts present the performance of a tanker configured with an air refueling buddy store on the centerline pylon, two 300-gallon external fuel tanks on wing station 75, and two 20-mm guns.

Tanker Speed Envelope

The operating speed envelope of the tanker aircraft, both with hose and drogue extended and retracted, is shown in figures 11-33 and 11-72. The airspeed of the tanker when the hose and drogue are extended is limited to a minimum airspeed of 200 KCAS and a maximum airspeed of 300 KCAS.

SAMPLE PROBLEM

Tanker Speed Envelope

(For figure 11-33)

(A) Pressure altitude . . . . 20,000 ft

(B) Gross weight hose and drogue extended . . . . 24,000 lb

(C) Minimum refueling Mach number 0.520

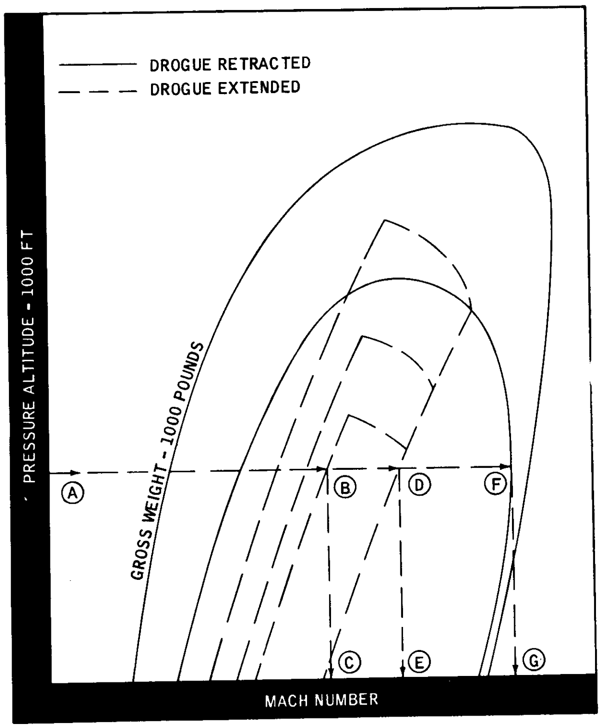
(D) Maximum refueling calibrated airspeed . . . . 300 kn

(E) Maximum refueling Mach number 0.65

(F) Gross weight hose and drogue retracted . . . . 24,000 lb

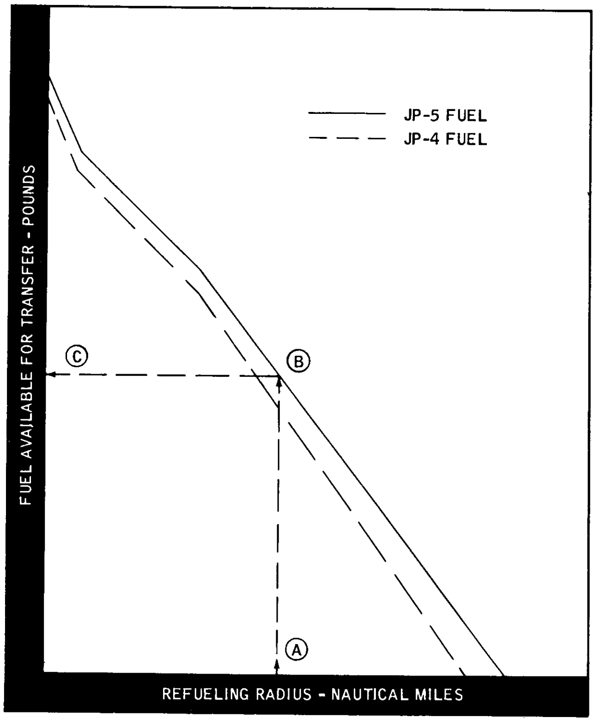
(G) Maximum Mach number 0.83

SAMPLE TANKER SPEED ENVELOPE



HH1-182

SAMPLE TANKER FUEL AVAILABLE FOR TRANSFER



HH1-181

Tanker Fuel Available for Tranfer

The tanker fuel available for transfer is shown in figures 11-34 and 11-73 for operation with JP-4 and JP-5 fuel. For a refueling radius less than 260(JP-4)-280 (JP-5) nautical miles, the tanker is unable to consume all the 320 gallons of nontransferable fuel. Therefore, if refueling is accomplished at less than 280 nautical miles and all available fuel is transferred to the receiver, the tanker will return to base with an excess of reserve fuel.

SAMPLE PROBLEM

Tanker Fuel Available for Transfer

(For figure 11-34)

(A) Refueling radius . . . . 500 NMI

(B) JP-5 fuel line

(C) Fuel available for transfer . . . . 3880 lb

Tanker Fuel Transfer Time

The relationship of fuel transferred to receiver versus elapsed time is presented in figures 11-35 and 11-74. The flow rate to the receiver aircraft is 180 gallons per minute. After 2.8 minutes, refueling is temporarily discontinued to allow the refueling store to fill from the external fuel tanks. After 2.5 minutes, refueling operation may be resumed. If less than 5600 pounds of JP-5 fuel is being transferred, refueling may be resumed in less than 2.5 minutes.

The external transfer rate of tanker fuel from the external fuel tanks and wing tanks to the refueling store limits the amount of fuel (875 gallons) that can be transferred to the receiver during a continuous refueling operation. If more than 875 gallons is to be transferred to the receiver, refueling must be discontinued for approximately 2.8 minutes, to allow the refueling store to be replenished from the tanker internal fuel before fueling can be resumed.

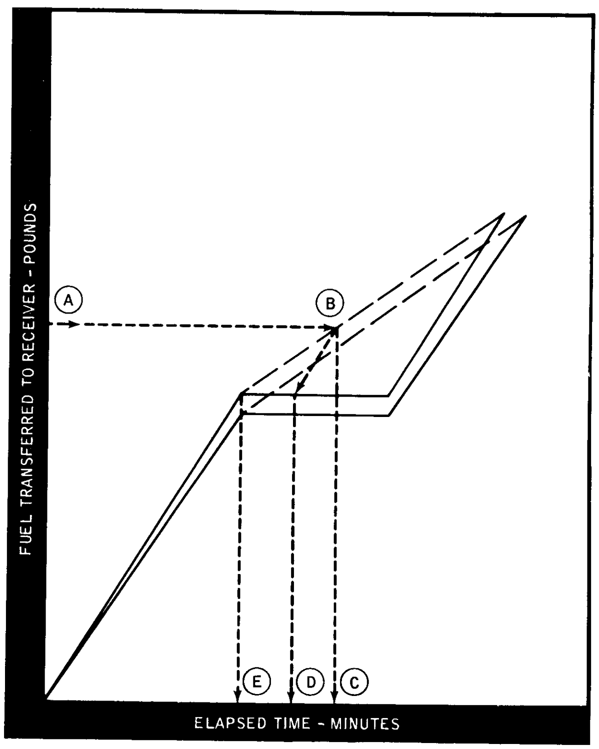
SAMPLE PROBLEM

Tanker Fuel Transfer Time

(For figure 11-35)

(A) Fuel transferred to receiver (JP-5) . . . . 4500 lb

SAMPLE TANKER FUEL TRANSFER TIME



HH1-183

(B) JP-5 fuel flow line

(C) Elapsed time . . . . 4.85 min

(D) Point where refueling is resumed . . . . 4.02 min

(E) Point where refueling is temporarily discontinued . . . . 2.85 min

Fuel Consumption of Tanker During Air Refueling

The tanker fuel consumption with the hose and drogue extended is presented in figures 11-36 and 11-75 for two pressure altitudes and range of operating airspeeds.

SAMPLE PROBLEM

Fuel Consumption of Tanker During Air Refueling

(For figure 11-36)

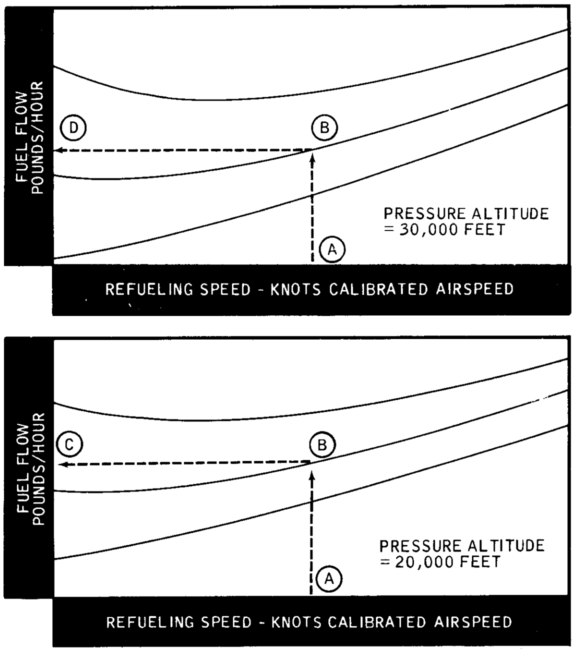
(A) Refueling speed . . . . 250 KCAS

(B) Gross weight . . . . 20, 000 lb

(C) Fuel flow – 20, 000 ft . . . . 2820 lb/hr

(D) Fuel flow – 30, 000 ft . . . . 3090 lb/hr

SAMPLE TANKER FUEL CONSUMPTION DURING AIR REFUELING



HH1-184

TANKER SPEED ENVELOPE

TANKER CONFIGURATION
1 — 300 GALLON REFUELING STORE PLUS 2 — 300 GALLON TANKS
5 PYLONS AND GUNS

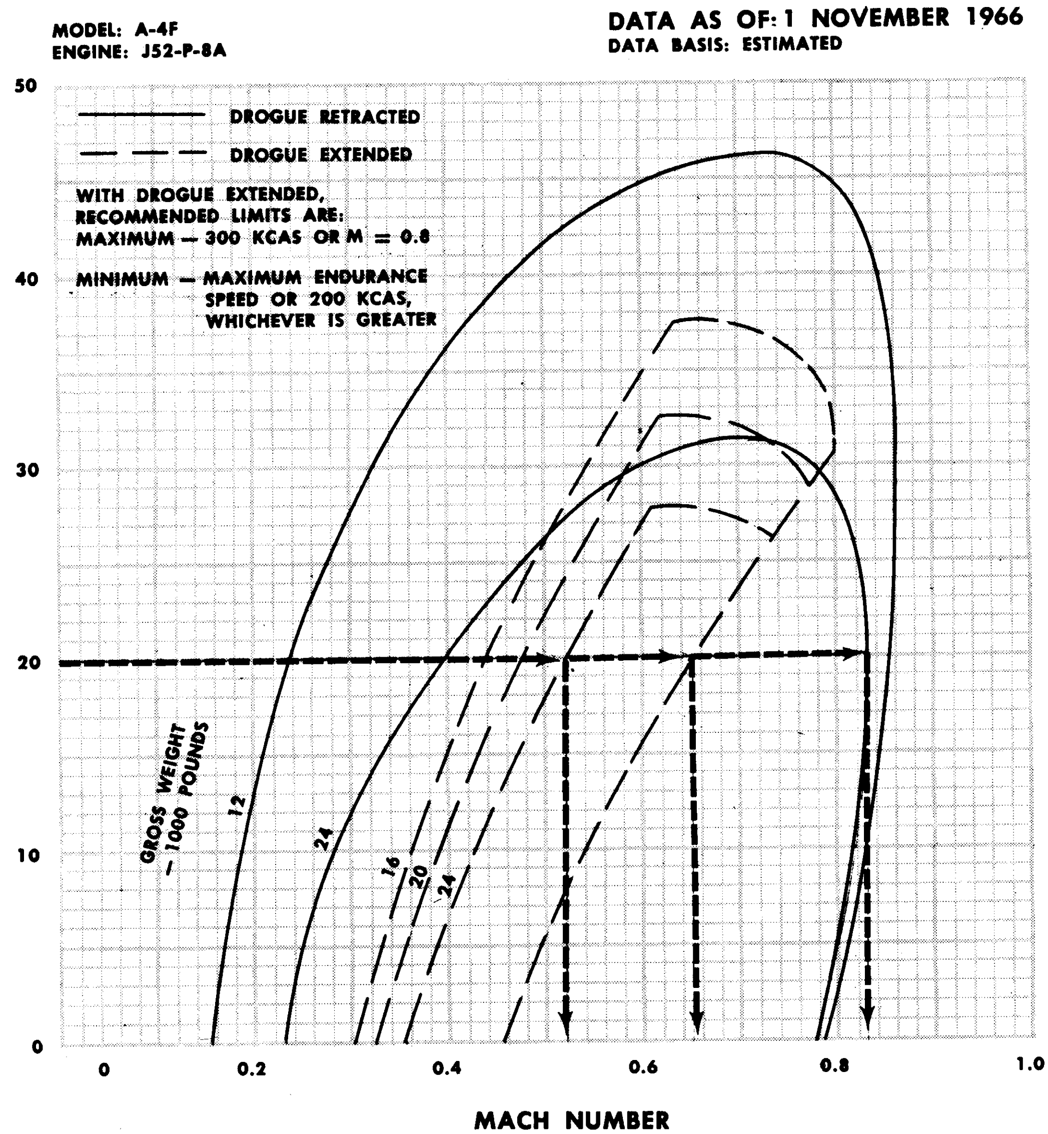


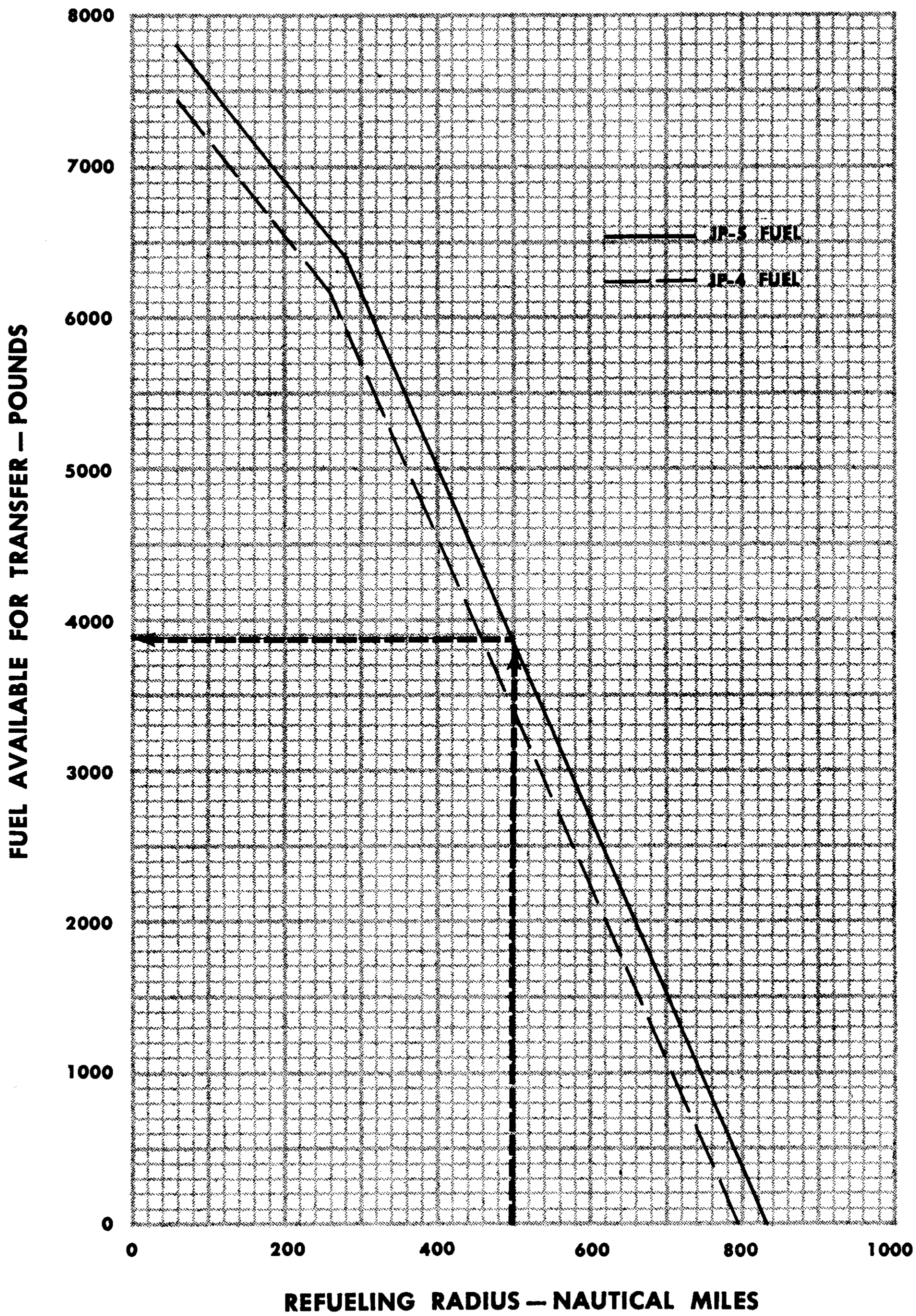
Figure 11-33. Tanker Speed Envelope

TANKER FUEL AVAILABLE FOR TRANSFER

1 — 300 GALLON REFUELING STORE PLUS 2 — 300 GALLON TANKS
5 PYLONS AND GUNS

MODEL: A-4F
ENGINE: J52-P-8A

DATA AS OF: 1 NOVEMBER 1966
DATA BASIS: ESTIMATED



HH1-186

Figure 11-34. Tanker Fuel Available for Transfer

TANKER FUEL TRANSFER TIME
TANKER CONFIGURATION

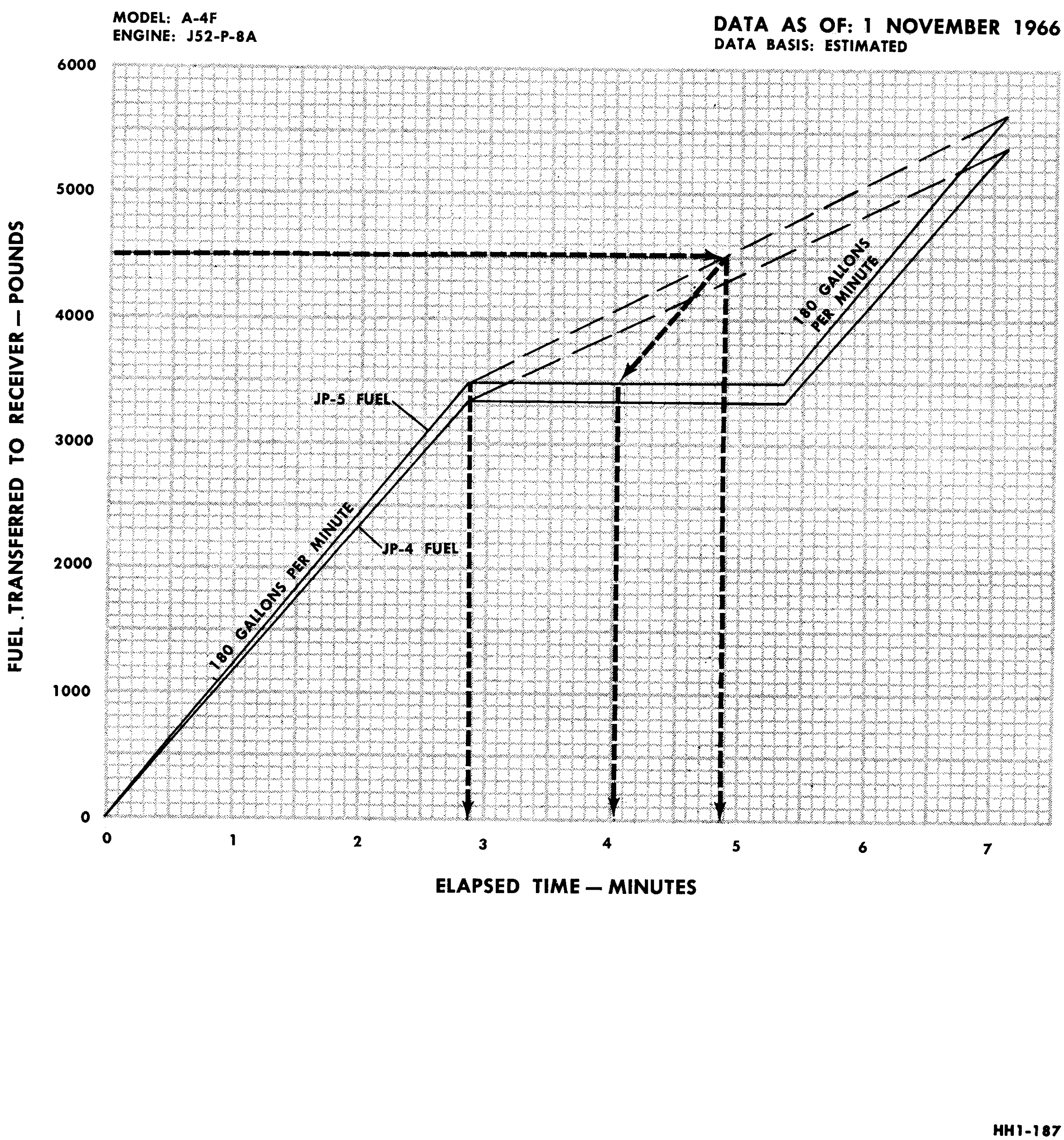


Figure 11-35. Tanker Fuel Transfer Time

FUEL CONSUMPTION OF TANKER DURING AIR REFUELING

1 — 300 GALLON REFUELING STORE PLUS 2 — 300 GALLON TANKS
5 PYLONS AND GUNS

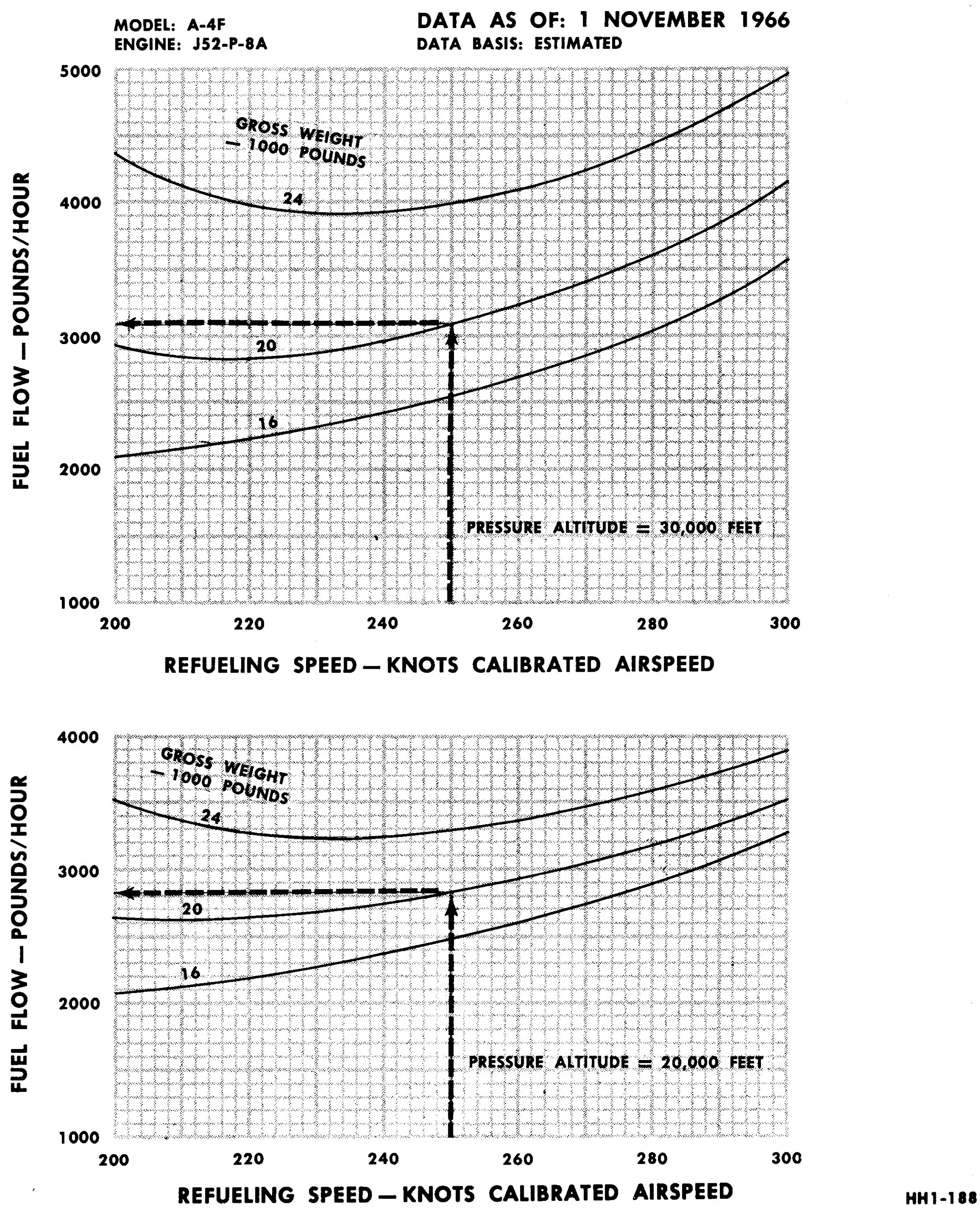


Figure 11-36. Fuel Consumption of Tanker During Air Refueling

PART 7
DESCENT

Maximum Range Descent

Graphical data is presented in figures 11-37 through 11-39 and 11-76 through 11-78 for a maximum range descent using idle thrust and with speedbrakes closed. Recommended maximum range descent speed, fuel consumed, distance covered, and elapsed time from any desired altitude to sea level are presented as a function of gross weight and drag index. All data is based on an ICAO standard atmosphere.

The method of presenting data for fuel, distance, and time is identical. Therefore, only one sample problem is shown.

SAMPLE PROBLEM

Descent Fuel

(For figure 11-37)

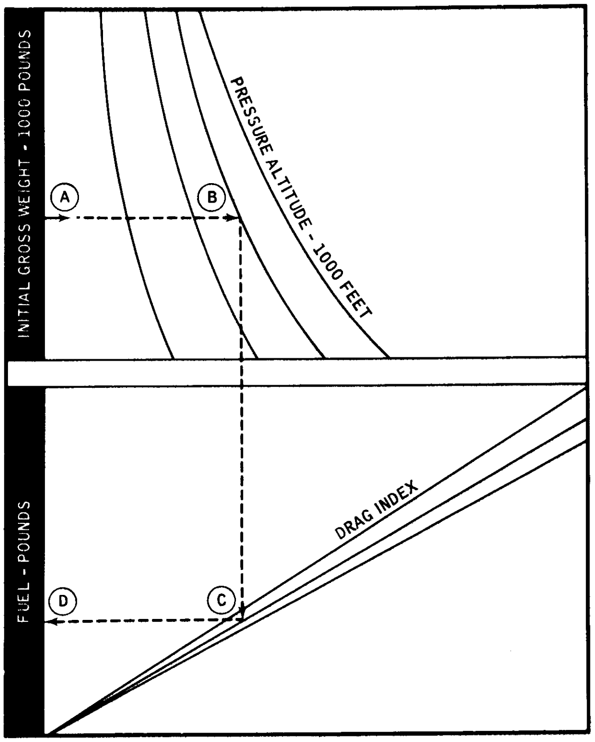
(A) Initial gross weight . . . . 14,000 lb

(B) Cruise altitude . . . . 35,000 ft

(C) Drag index 0

(D) Fuel required from cruise altitude to sea level . . . . 139 lb

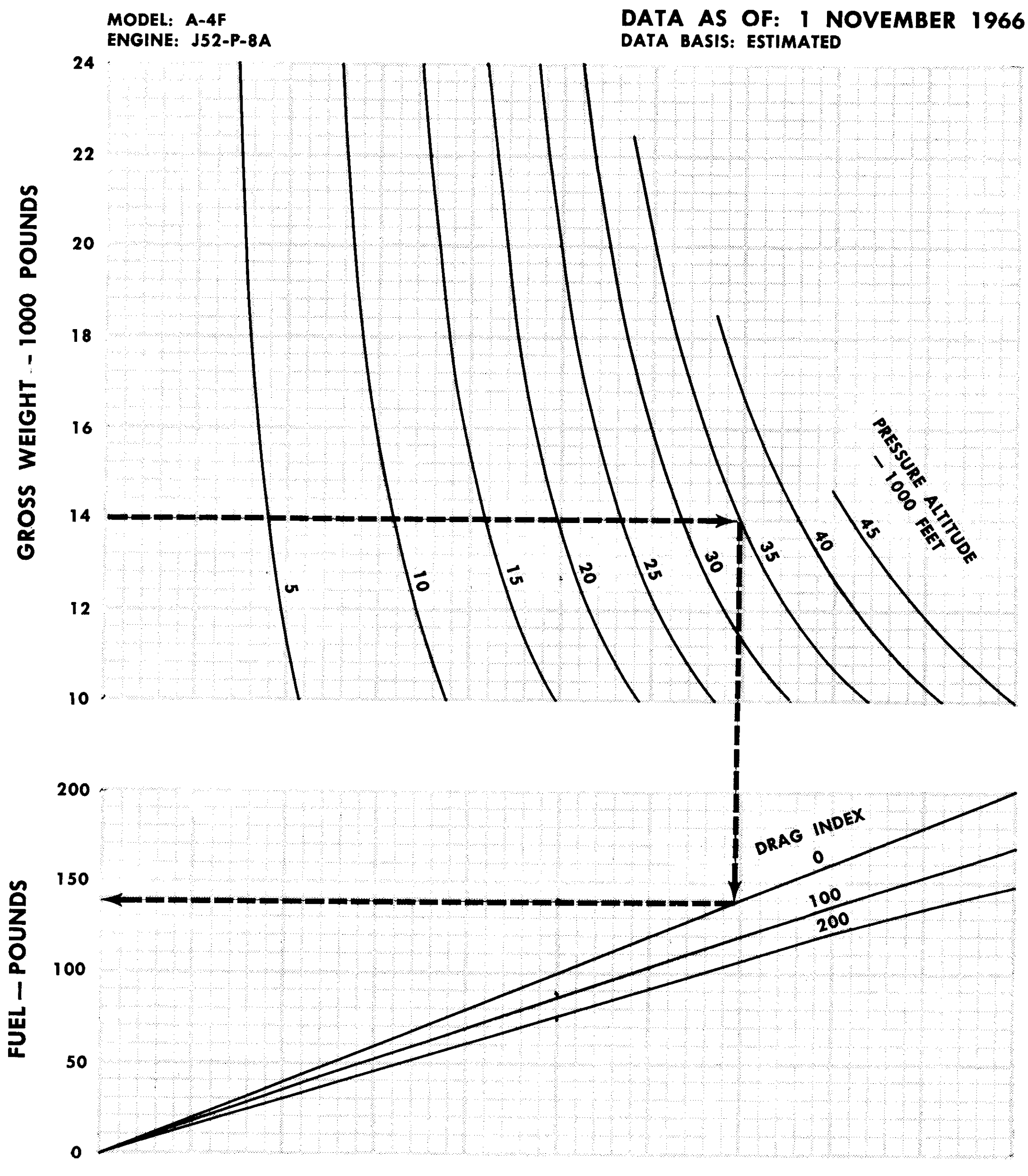
SAMPLE DESCENT FUEL



HH1-189

DESCENT FUEL

IDLE THRUST



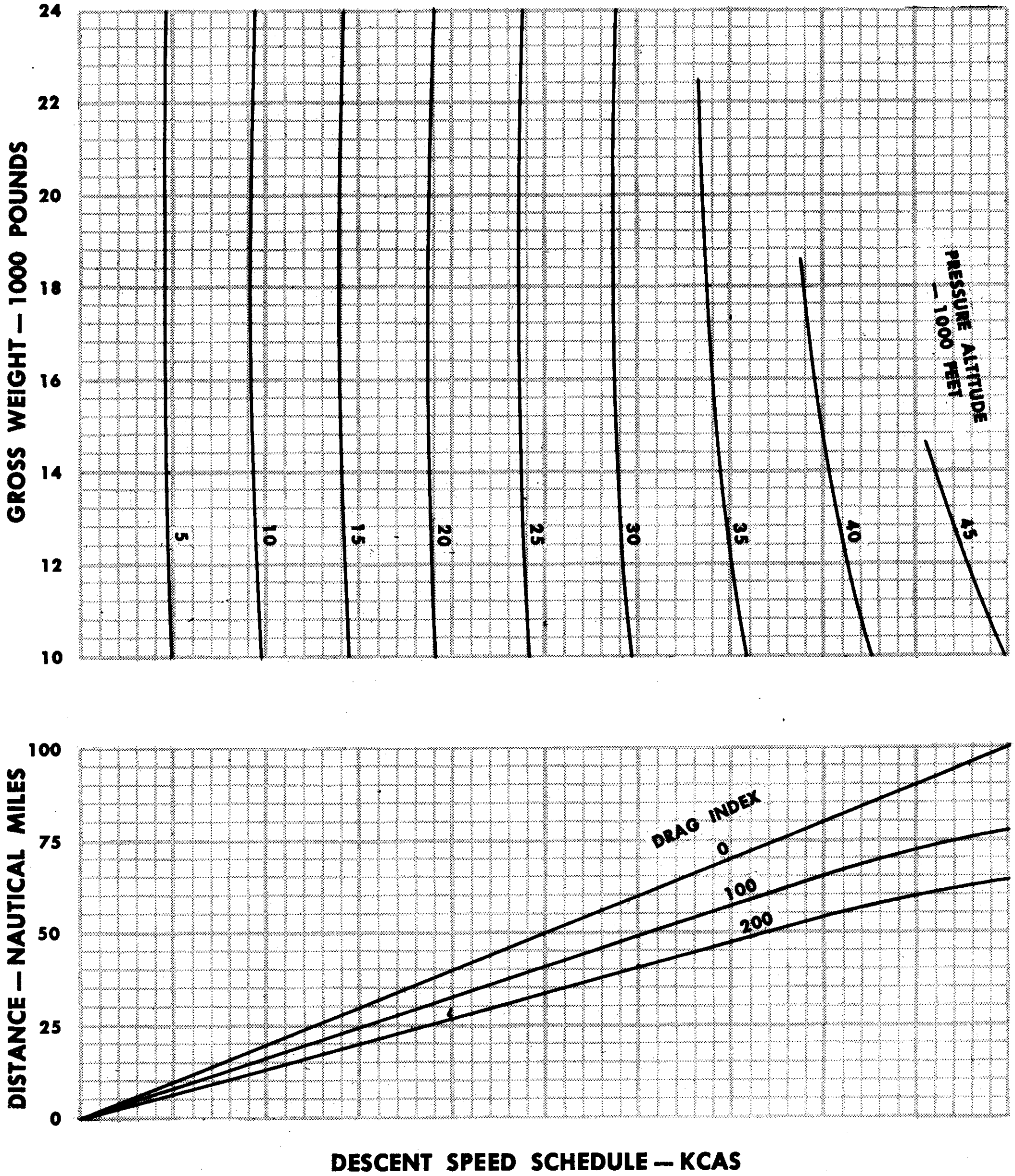
HH1-190

Figure 11-37. Descent Fuel

DESCENT DISTANCE
IDLE THRUST

MODEL: A-4F
ENGINE: J52-P-8A

DATA AS OF: 1 NOVEMBER 1966
DATA BASIS: ESTIMATED

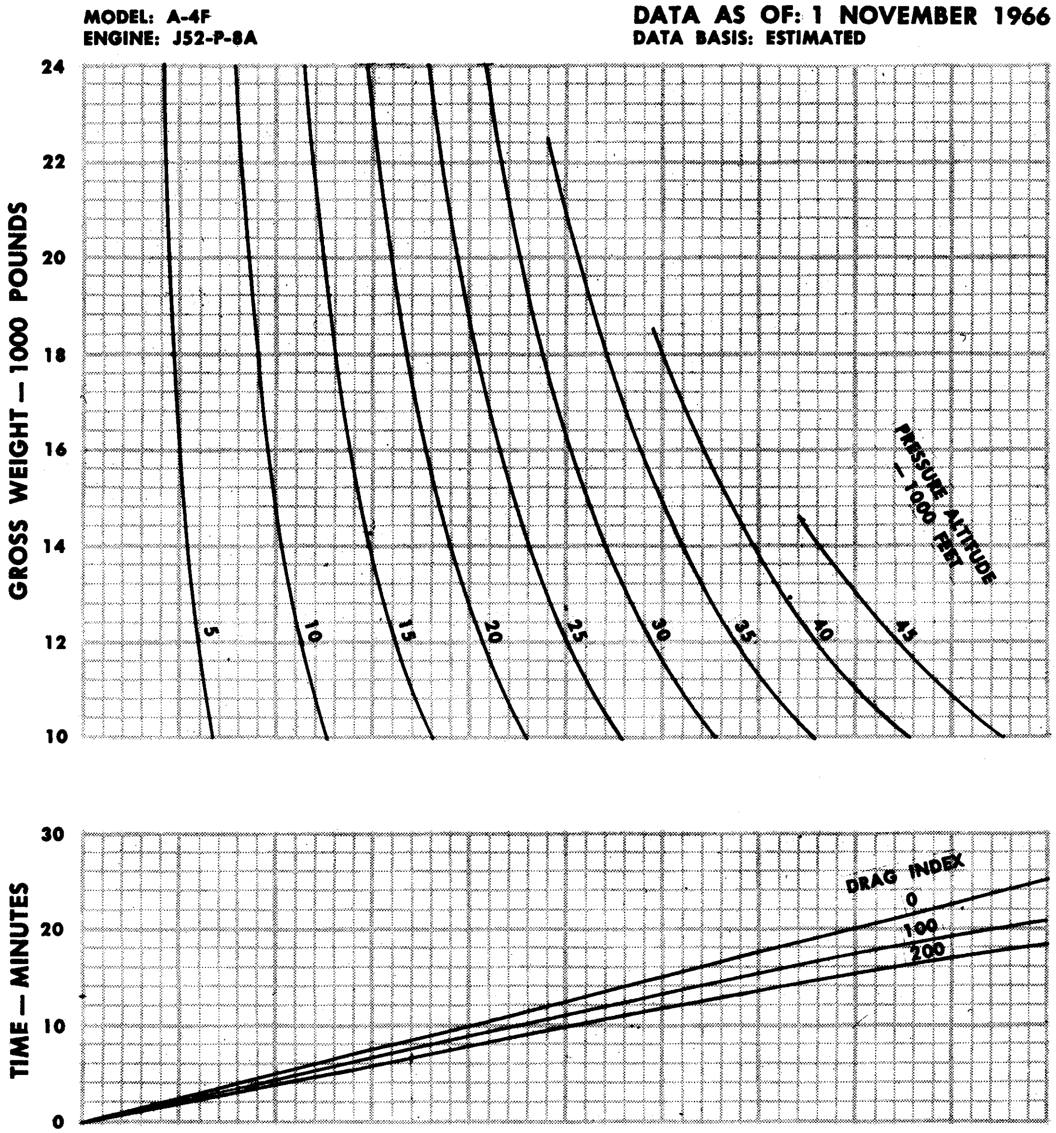


	GROSS WEIGHT — 1000 POUNDS							
DRAG INDEX	10	12	14	16	18	20	22	24
0	175	190	205	220	235	250	260	270
100	160	175	190	205	215	225	235	245
200	150	165	180	190	200	210	220	230

HH1-191

Figure 11-38. Descent Distance

DESCENT TIME
IDLE THRUST



HH1-192

Figure 11-39. Descent Time

PART 8
LANDING

Landing

Approach speeds, stall speeds for landing configurations, and corresponding angle-of-attack units are presented in figures 11-40 and 11-79. The speeds are shown as indicated airspeeds. If an angle-of-attack indication of 17.5 units with flaps fully extended does not produce the indicated airspeed for the configuration computed from figures 11-40 and 11-79, check the aircraft configuration. If the appropriate configuration is established, disregard the angle-of-attack indicator and make the approach at the indicated airspeed from figures 11-40 and 11-79.

The landing ground roll of the aircraft is dependent upon runway pressure altitude, outside air temperature, the force of the headwind, flap deflection, runway gradient, and braking action. The ground roll distance, as given in figures 11-41 and 11-80, is calculated assuming maximum braking action without skidding the tires, and aerodynamic braking produced with the speedbrakes and spoilers extended, and the wing flaps at any setting. A graph is provided for determining landing distance for various runway conditions including hard dry, wet, snow-covered, and icy runways. The distance to clear a 50-foot obstacle is measured horizontally from the 50-foot obstacle to the end of rollout and is obtained by adding 715 feet to the ground roll distance, assuming a standard 4-degree glide slope. Obviously, if the obstacle is situated at a distance from the runway which is greater than the ground distance required (715 feet) to descend from 50 feet, it will have no effect on the usable runway length. If the obstacle is very near the runway, that portion of runway length consumed in the descent from 50 feet may not leave enough distance to brake to a stop.

SAMPLE PROBLEM

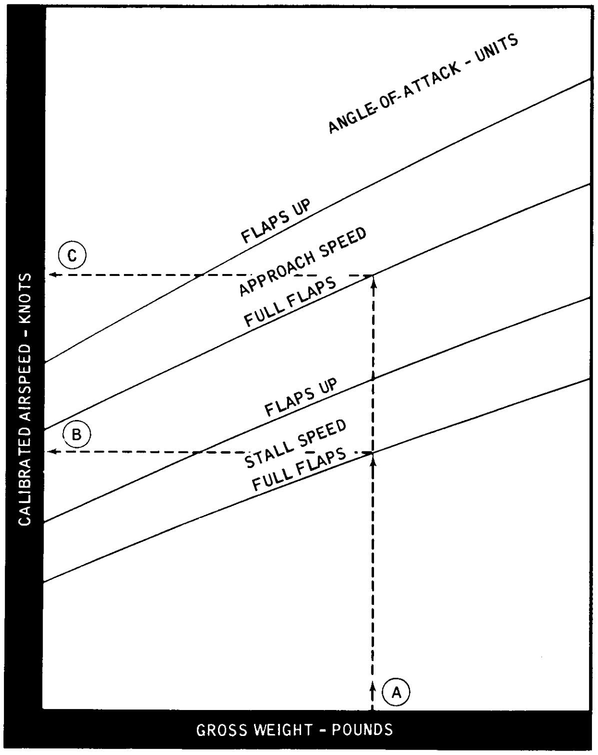
Approach Speed

(For figure 11-40)

(A) Gross weight . . . . 12,000 lb

(B) Stall speed (Full flaps) . . . . 99.7 KIAS
Angle-of-attack . . . . 25.4 units

SAMPLE APPROACH SPEED



HH1-193

(C) Approach speed (Full flaps) . . . . . . 116.3 KIAS
Angle-of-attack . . . . 17.5 units

SAMPLE PROBLEM

Landing Distance

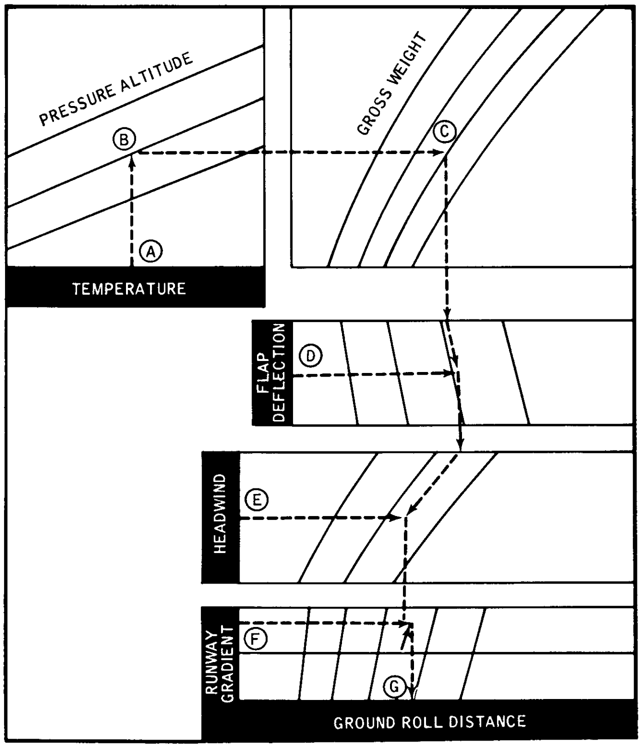
(For figure 11-41, sheet 2)

Runway Condition: Wet

(A) Outside air temperature . . . . 20°C

(B) Runway pressure altitude . . . . 2000 ft

SAMPLE LANDING DISTANCE



HH1-194

(C) Aircraft landing weight . . . . 12,000 lb

(D) Flap deflection . . . . half

(E) Headwind . . . . 15 kn

(F) Runway gradient . . . . -1 percent

(G) Ground roll distance . . . . 4130 ft NEW

Total distance to clear a 50-foot obstacle with 4-degree glide slope . . . . 4845 ft NEW

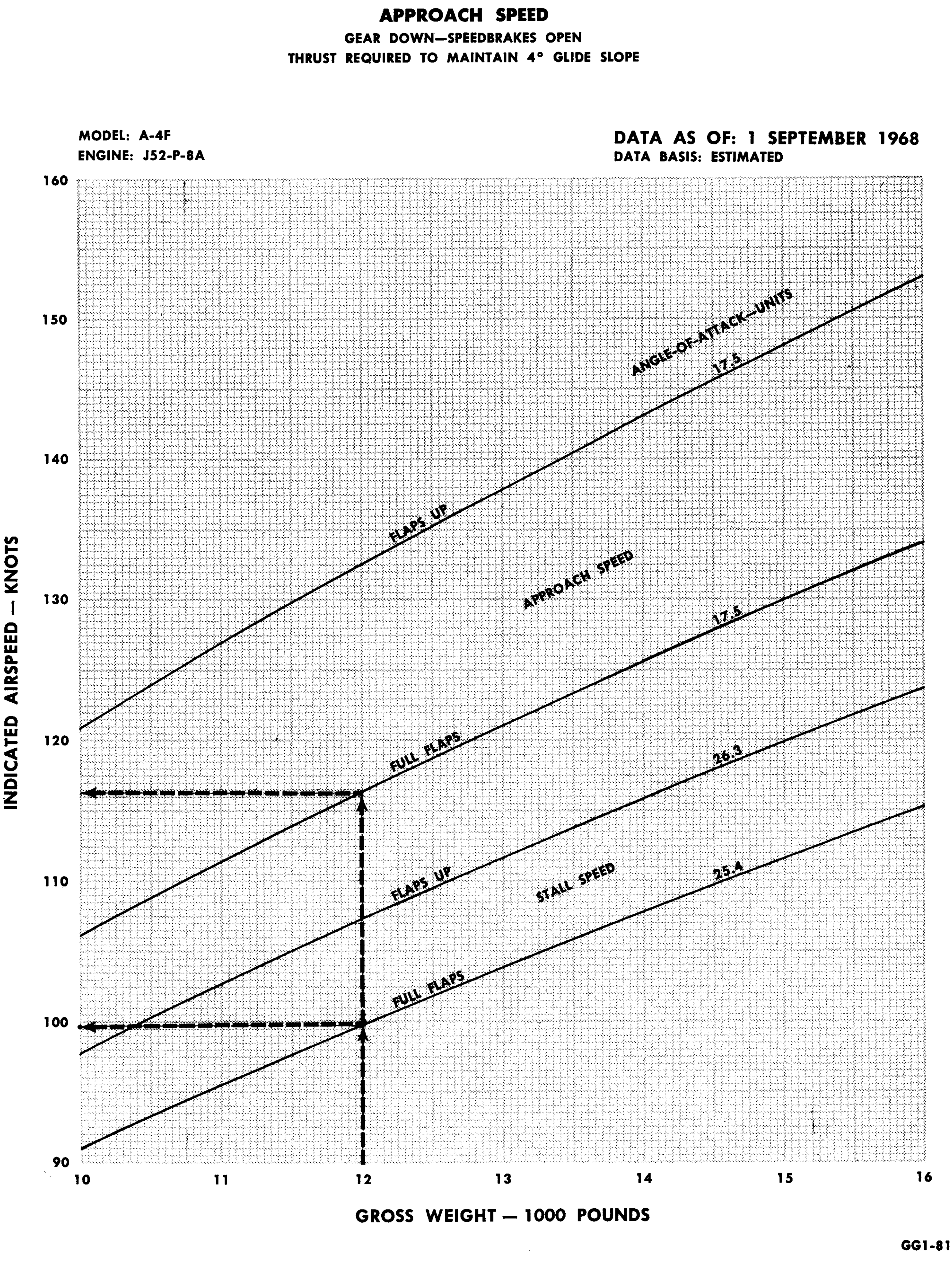


Figure 11-40. Approach Speed

LANDING DISTANCE
HARD SURFACE RUNWAY
DRY
SPEEDBRAKES AND SPOILERS OPEN
RCR = 23

MODEL A-4F
ENGINE: J52-P-8A

DATA AS OF: 15 DECEMBER 1969
DATA BASIS: FLIGHT TEST

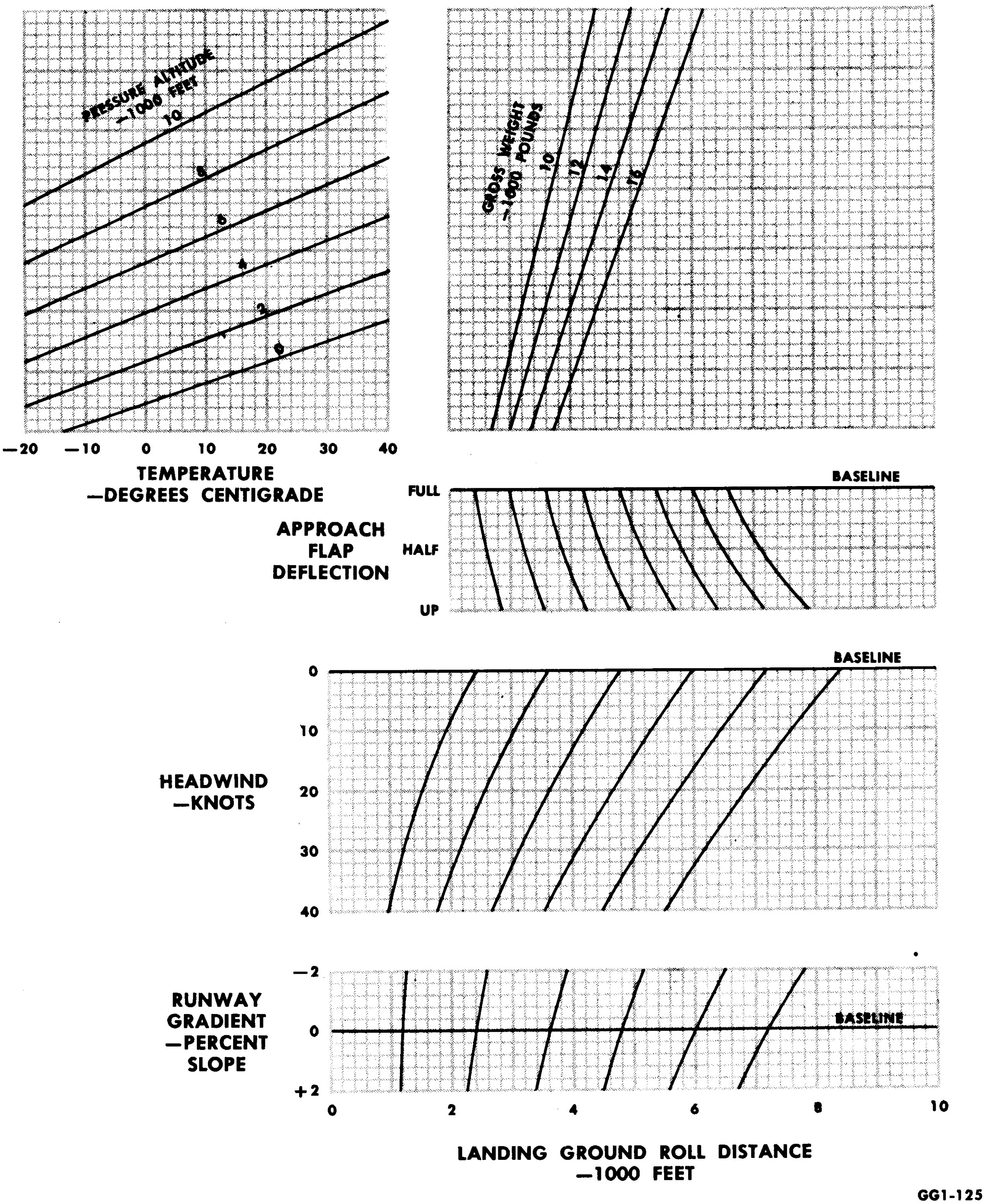


Figure 11-41. Landing Distance (Sheet 1)

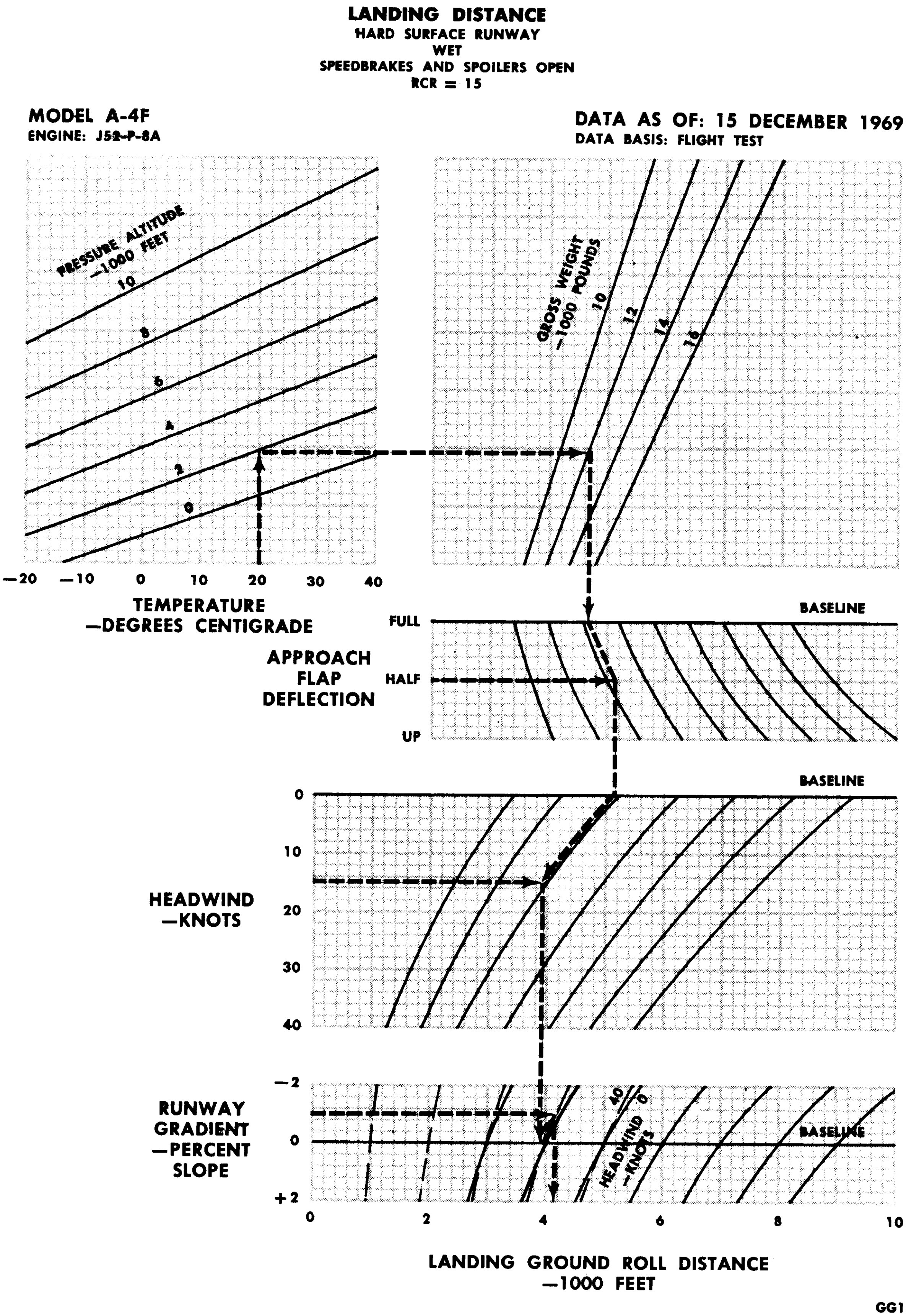


Figure 11-41. Landing Distance (Sheet 2)

LANDING DISTANCE
HARD SURFACE RUNWAY
SNOW AND ICE
SPEEDBRAKES AND SPOILERS OPEN
RCR = 9

MODEL A-4F
ENGINE: J52-P-8A

DATA AS OF: 15 DECEMBER 1969
DATA BASIS: FLIGHT TEST

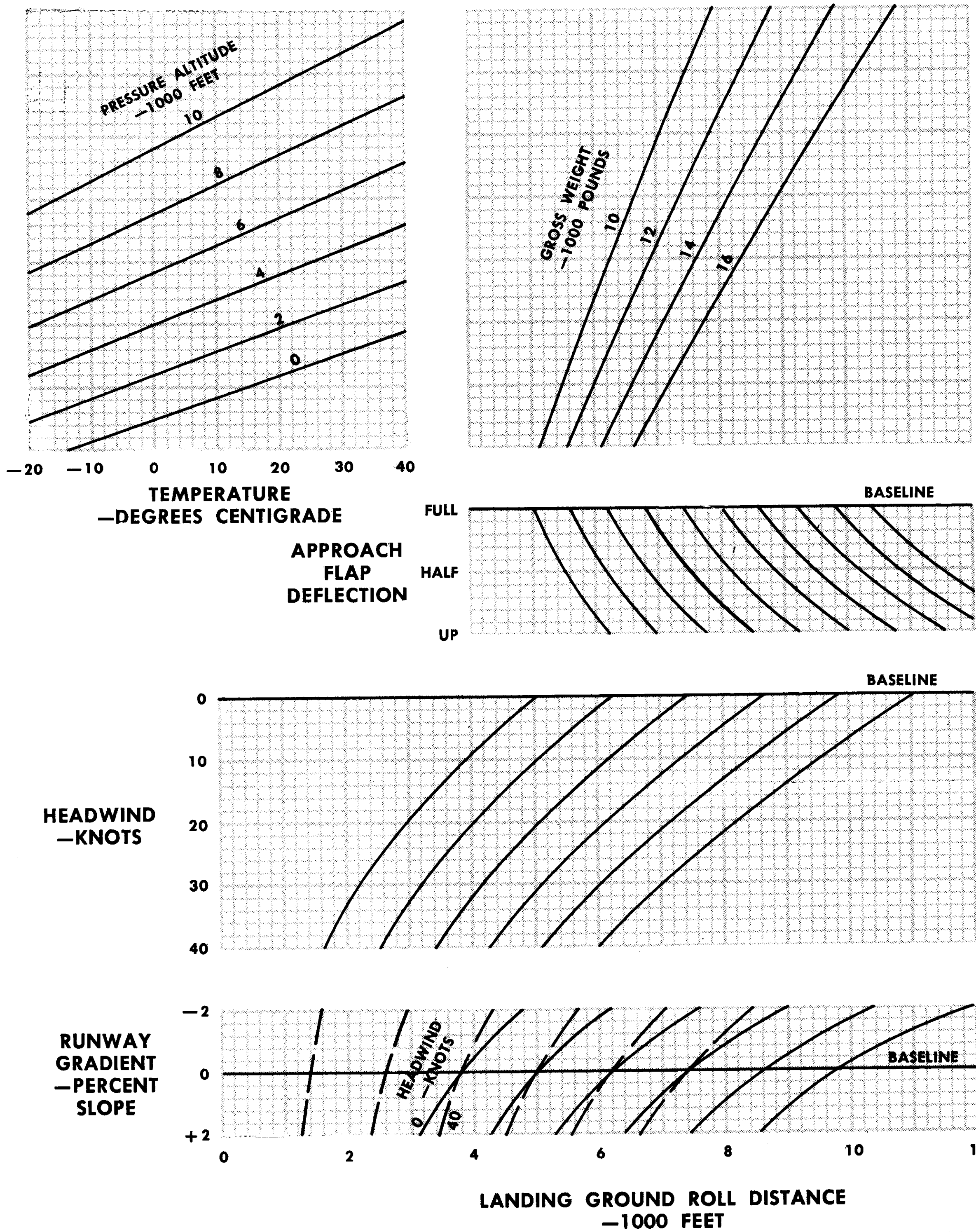


Figure 11-41. Landing Distance (Sheet 3)

LANDING DISTANCE

HARD SURFACE RUNWAY
DRY
SPEEDBRAKES OPEN
NO SPOILERS
RCR = 23

MODEL A-4F
ENGINE: J52-P-8A

DATA AS OF: OCTOBER 1968
DATA BASIS: FLIGHT TEST (NAVY)

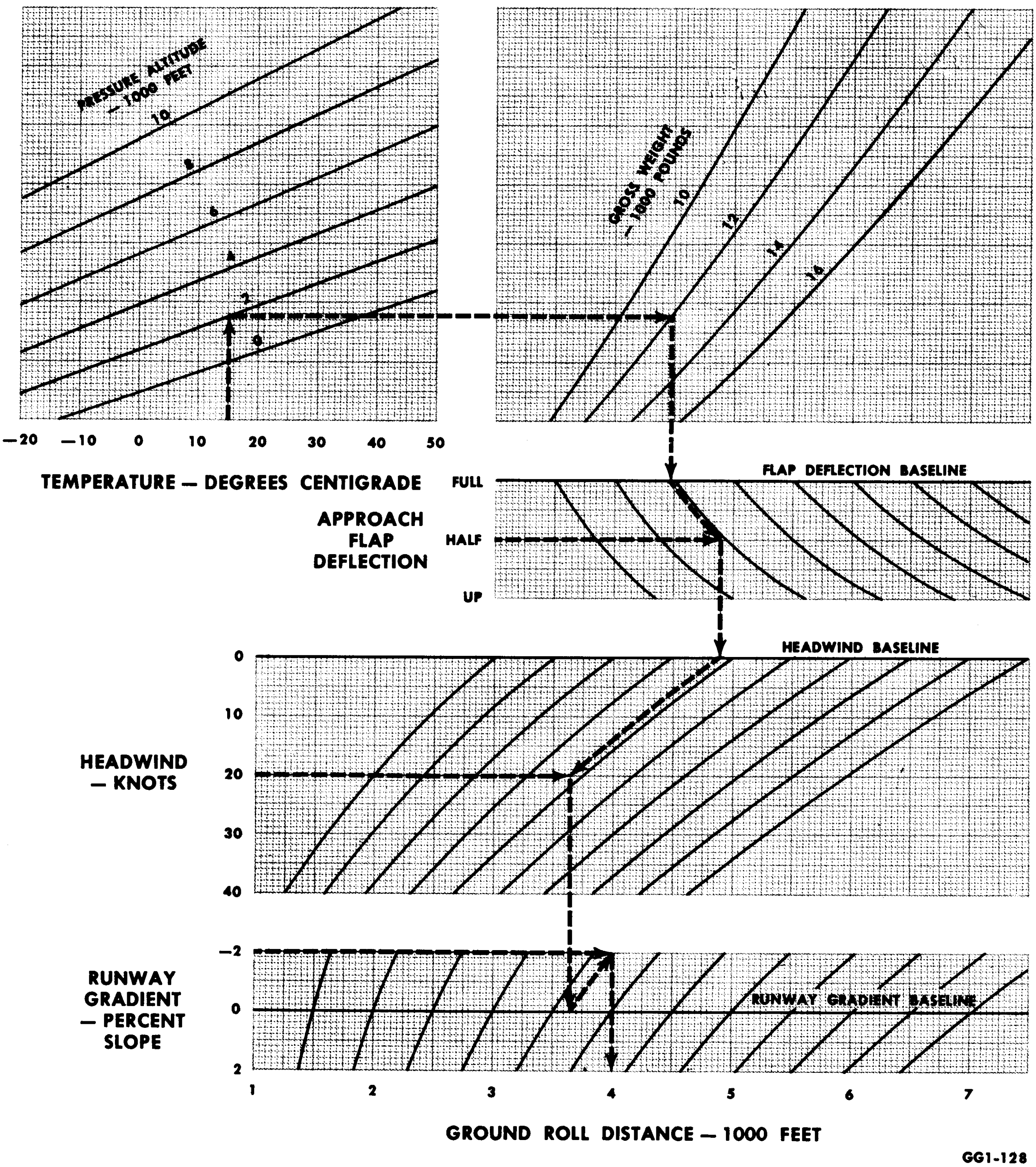


Figure 11-41. Landing Distance (Sheet 4)

LANDING DISTANCE

HARD SURFACE RUNWAY
WET
SPEEDBRAKES OPEN
NO SPOILERS
RCR = 15

MODEL A-4F
ENGINE: J52-P-8A

DATA AS OF: OCTOBER 1968
DATA BASIS: FLIGHT TEST (NAVY)

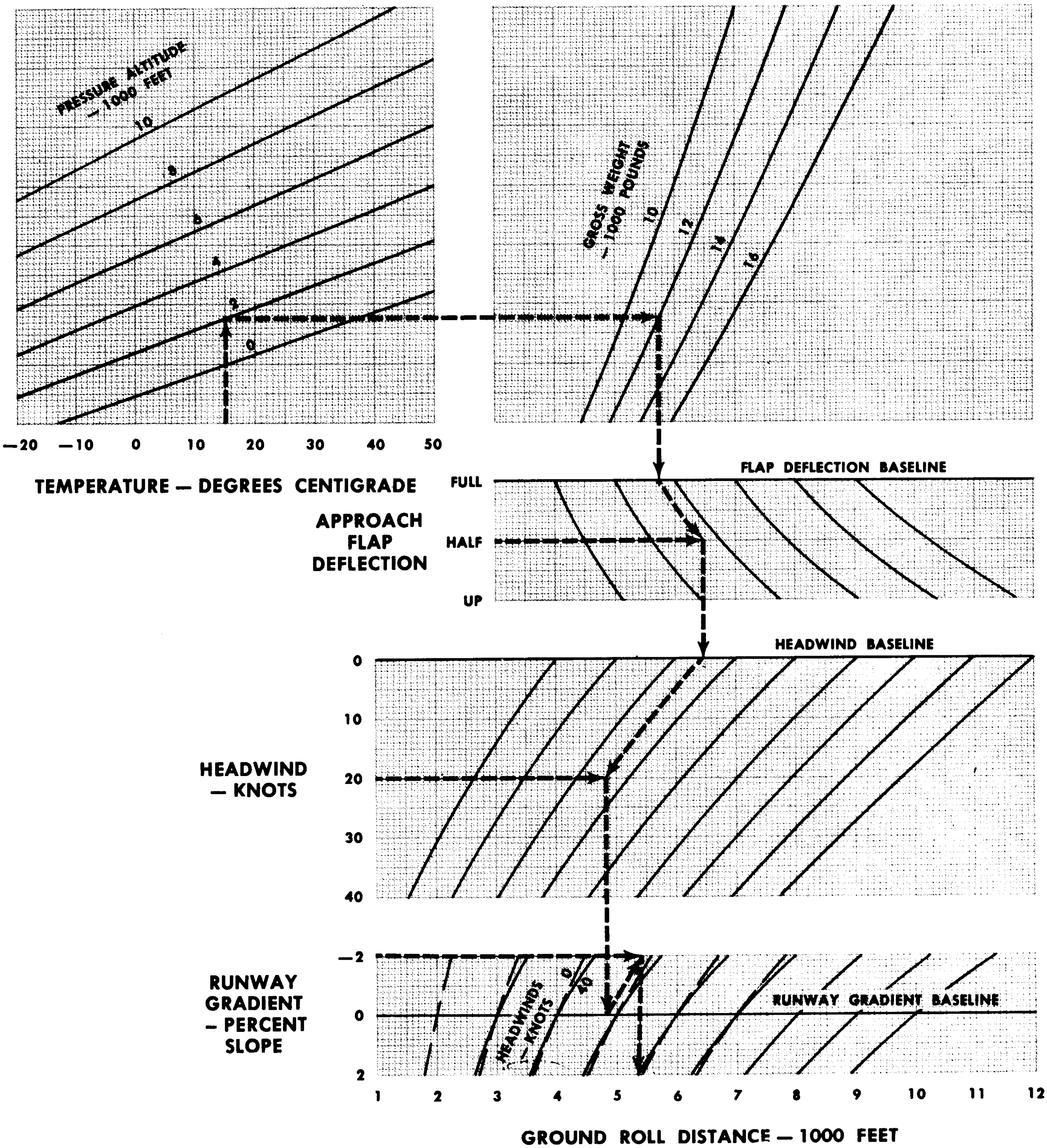


Figure 11-41. Landing Distance (Sheet 5)

LANDING DISTANCE
HARD SURFACE RUNWAY
SNOW AND ICE
SPEEDBRAKES OPEN
NO SPOILERS
RCR = 9

MODEL A-4F
ENGINE: J52-P-8A

DATA AS OF: OCTOBER 1968
DATA BASIS: FLIGHT TEST (NAVY)

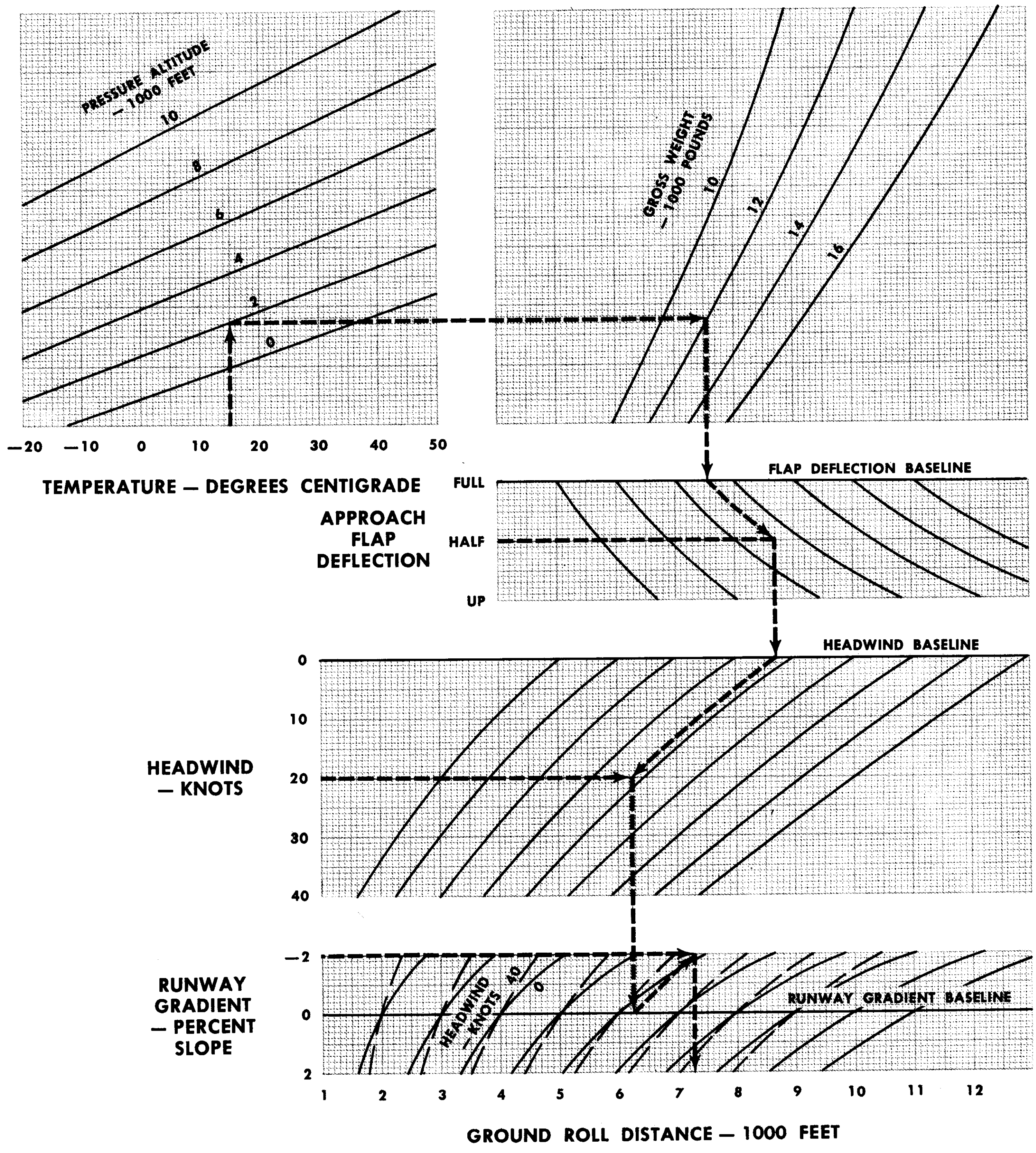


Figure 11-41. Landing Distance (Sheet 6)

PART 9
COMBAT PERFORMANCE

Combat Performance

This part contains the performance charts associated with the combat phase of the mission. Maximum Mach number and turning radius data are included.

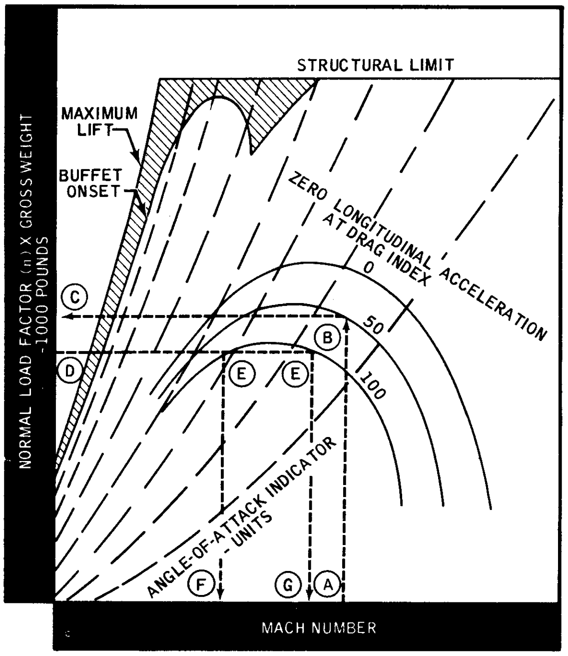
Turning Radius

The turning radius nomograph, figure 11-42, presents data for steady state level turns as a function of true airspeed, normal load factor, bank angle, distance traveled, and heading change. When used in conjunction with the load factor limitations of the maneuverability charts, figure 11-43, the aerodynamic, engine, and structural characteristics of the aircraft are taken into account.

NOTE

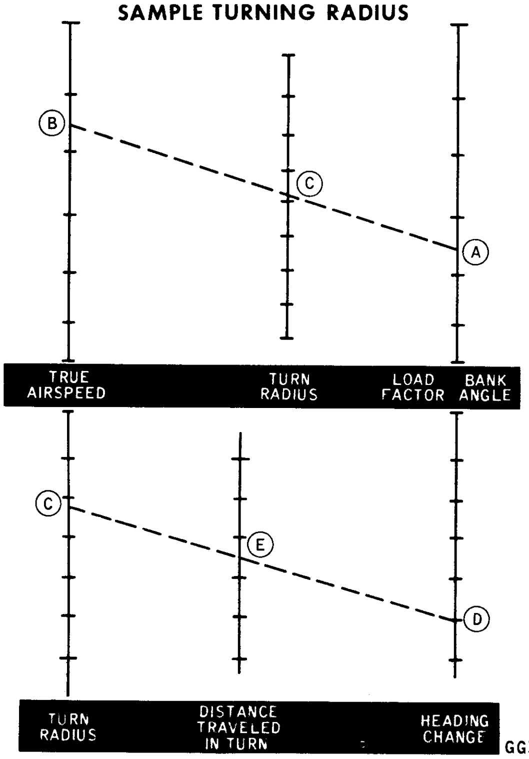
At normal low level airspeeds a rough planning aid for turning radius is the use of a dime on an ONC (1:1,000,000), or a quarter on a PC (1:500,000).

SAMPLE MANEUVERABILITY



GG1-82

SAMPLE TURNING RADIUS



GG1-111

SAMPLE PROBLEM

Turning Radius

(For figure 11-42)

From Maneuverability Sample Problem 1 (Figure 11-43)

Mach Number 0.75

Normal Load Factor 3.0

(A) Normal Load Factor 3.0
(Bank Angle. . . . . 70.5 Degrees)

(B) True Airspeed . . . . 496 knots
(From figure 11-2)

(C) Turning Radius. . . . . 7700 ft

(D) Heading change . . . . 90 degrees

(E) Distance Traveled in Turn . . . . . . 13,000 ft

Maneuverability

Low altitude maneuverability characteristics of A-4E/F aircraft are shown in figures 11-43 and 11-82. These data provide a means of determining either the maximum load factor attainable at a specified Mach number (sample problem 1) or the maximum (and minimum) Mach number for a predetermined load factor requirement (sample problem 2). These data are presented as a function of altitude, weight-times-load factor, Mach number, drag index, and angle-of-attack for zero longitudinal acceleration. Superimposed on the graphs are lines showing maximum lift, buffet onset, and structural limit. All data presented are based on the engine developing military thrust.

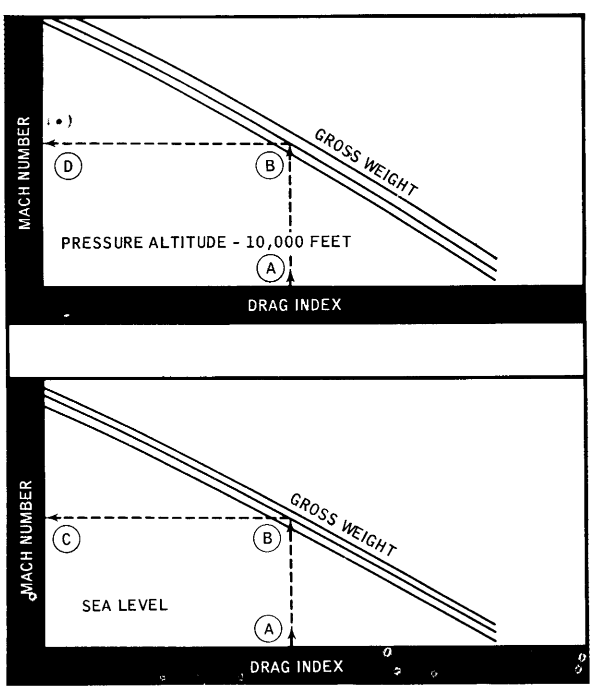
SAMPLE PROBLEM 1

Maneuverability

(For figure 11-43, sheet 1)

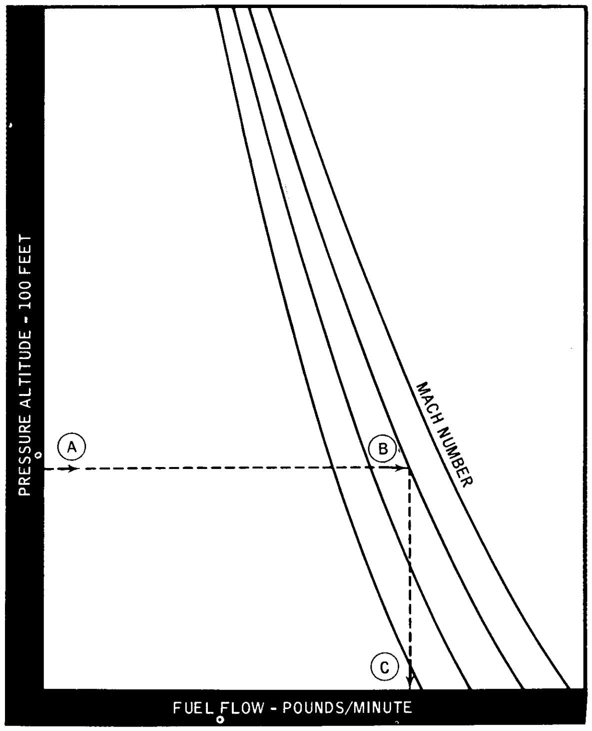
	Altitude	Sea level
	Gross weight	18,000 lb
(A)	Mach number	0.75
(B)	Drag index	50
(C)	Normal load factor x gross weight	54,500 lb
	Gross weight	18,000 lb
	Normal load factor at zero longitudinal acceleration	3.0g

SAMPLE MAXIMUM MACH NUMBER



HH1-199

SAMPLE MILITARY FUEL FLOW



HH1-200

SAMPLE PROBLEM 2

Maneuverability

(For figure 11-43, sheet 1)

	Altitude	Sea level
	Gross weight	20,000 lb
	Normal load factor required	2.5g
(D)	Normal load factor x gross weight	50,000 lb
(E)	Drag index	100
(F)	Minimum Mach number at 2.5g	0.411
(G)	Maximum Mach number at 2.5g	0.695

Maximum Mach Number

Level flight maximum Mach number, at military thrust, is shown in figures 11-44 and 11-83 as a function of drag index and gross weight at altitudes of sea level and 10,000 feet. Corresponding fuel flow data is shown on figures 11-45 and 11-84.

SAMPLE PROBLEM

Maximum Mach Number

(For figure 11-44)

(A) Drag index 60

(B) Gross weight at sea level . . . . 18,000 lb

(C) Mach number 0.804

SAMPLE PROBLEM

Military Fuel Flow

(For figure 11-45)

(A) Pressure altitude . . . . 10,000 ft

(B) Mach number 0.80

(C) Fuel flow . . . . 116.5 lb/min

TURNING RADIUS

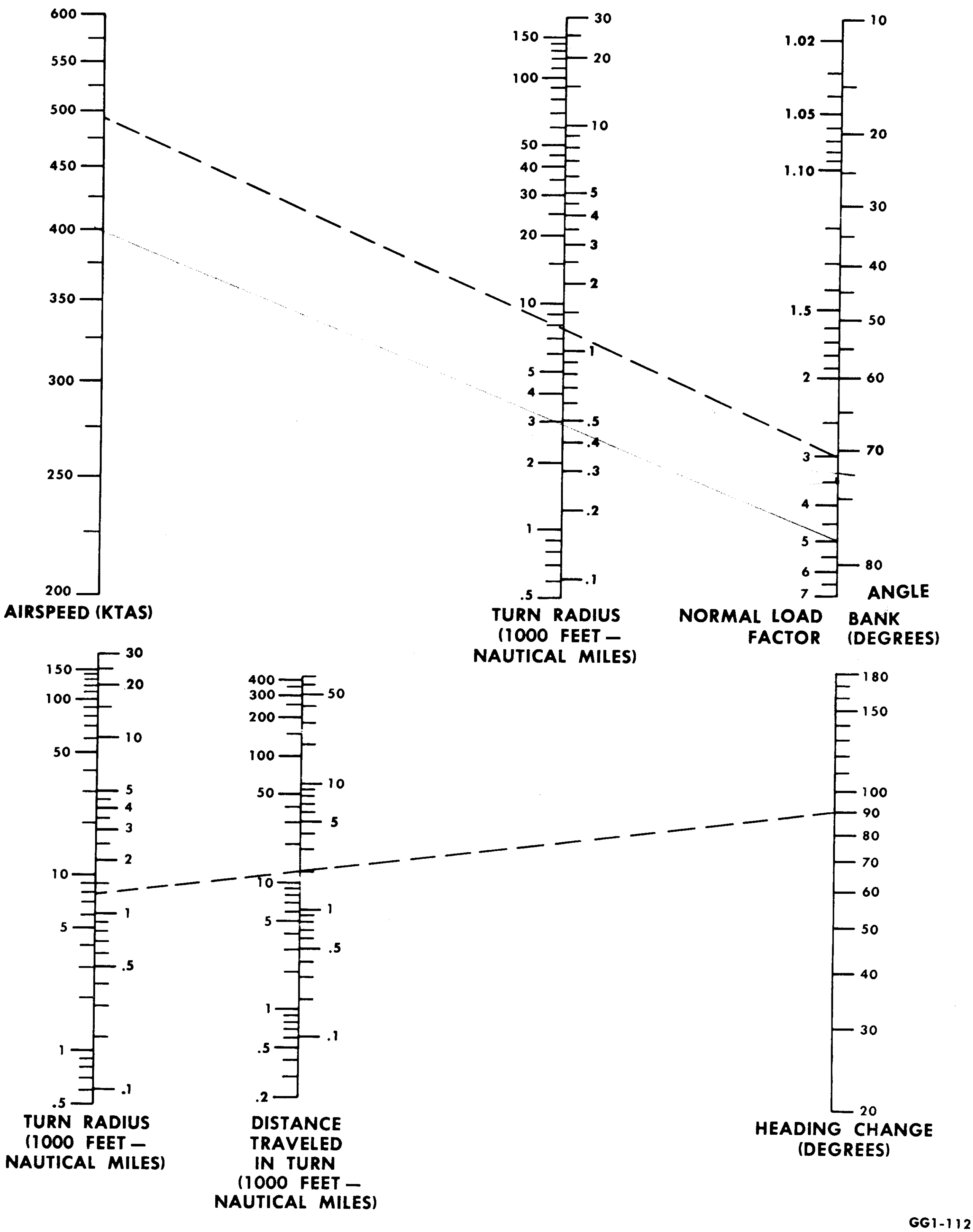


Figure 11-42. Turning Radius

MANEUVERABILITY
MILITARY THRUST
SEA LEVEL STANDARD DAY

FLAPS UP
GEAR UP

MODEL: A-4F
ENGINE: J52-P-8A

DATA AS OF: 1 NOVEMBER 1966
DATA BASIS: ESTIMATED

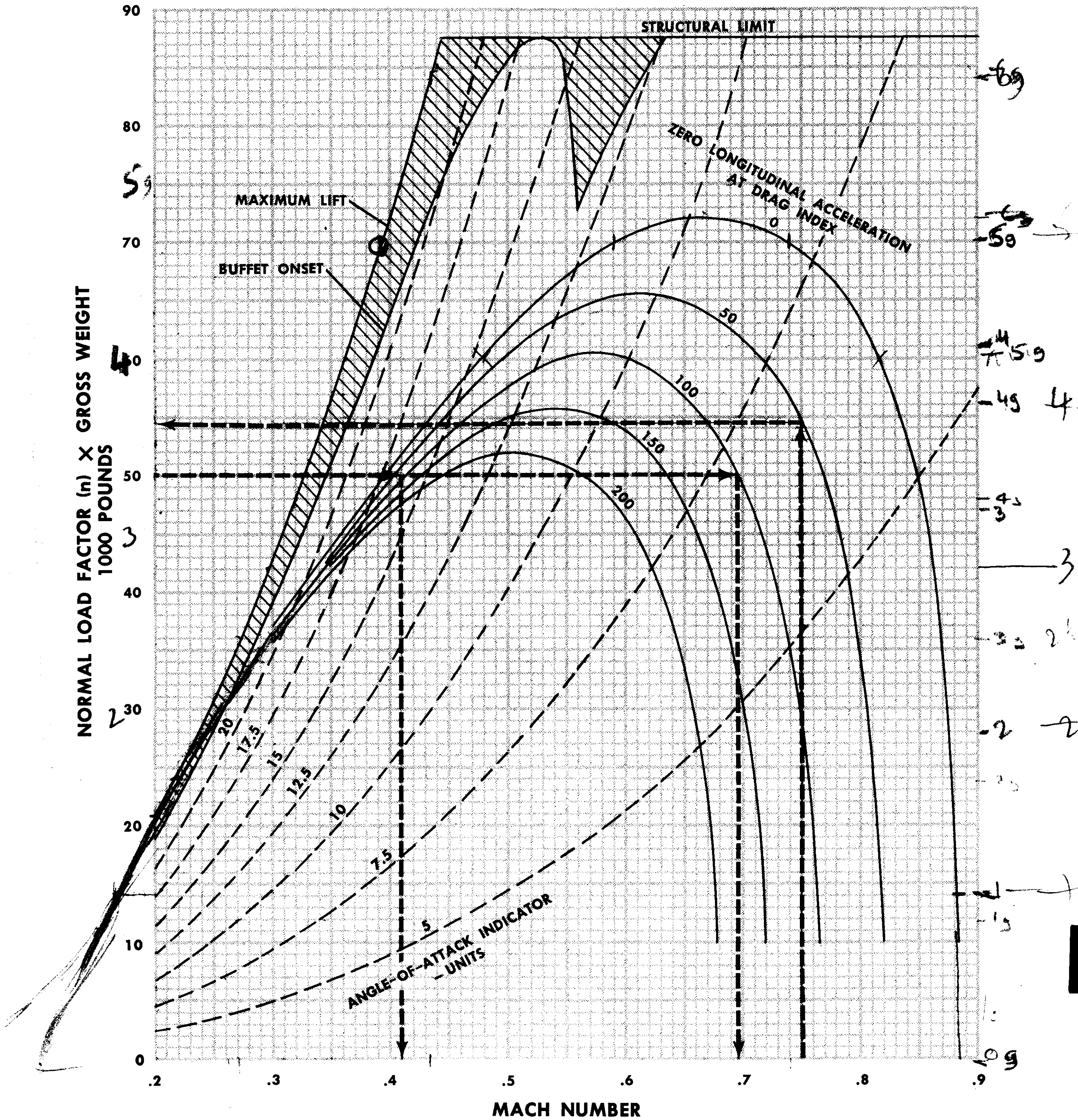


Figure 11-43. Maneuverability (Sheet 1)

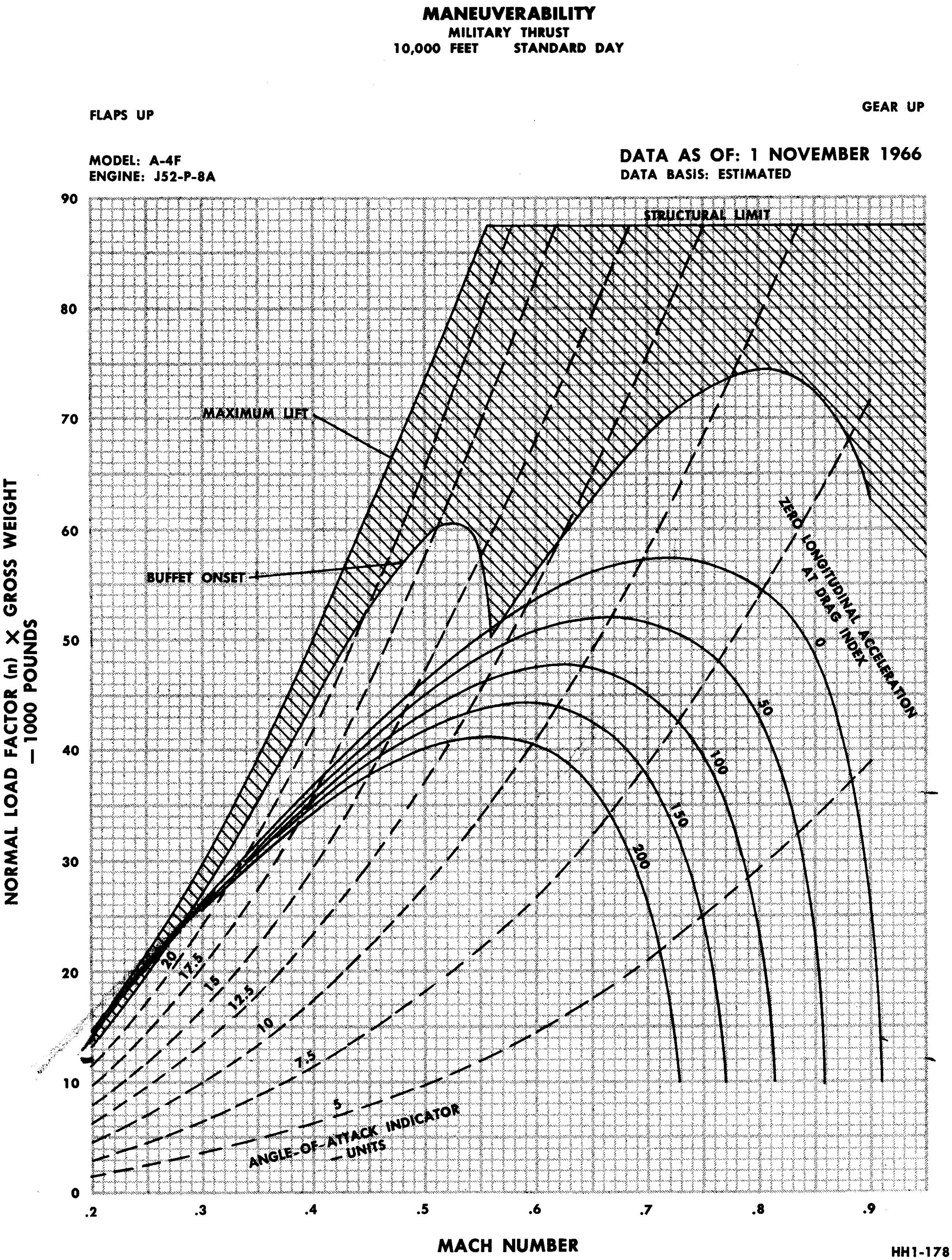


Figure 11-43. Maneuverability (Sheet 2)

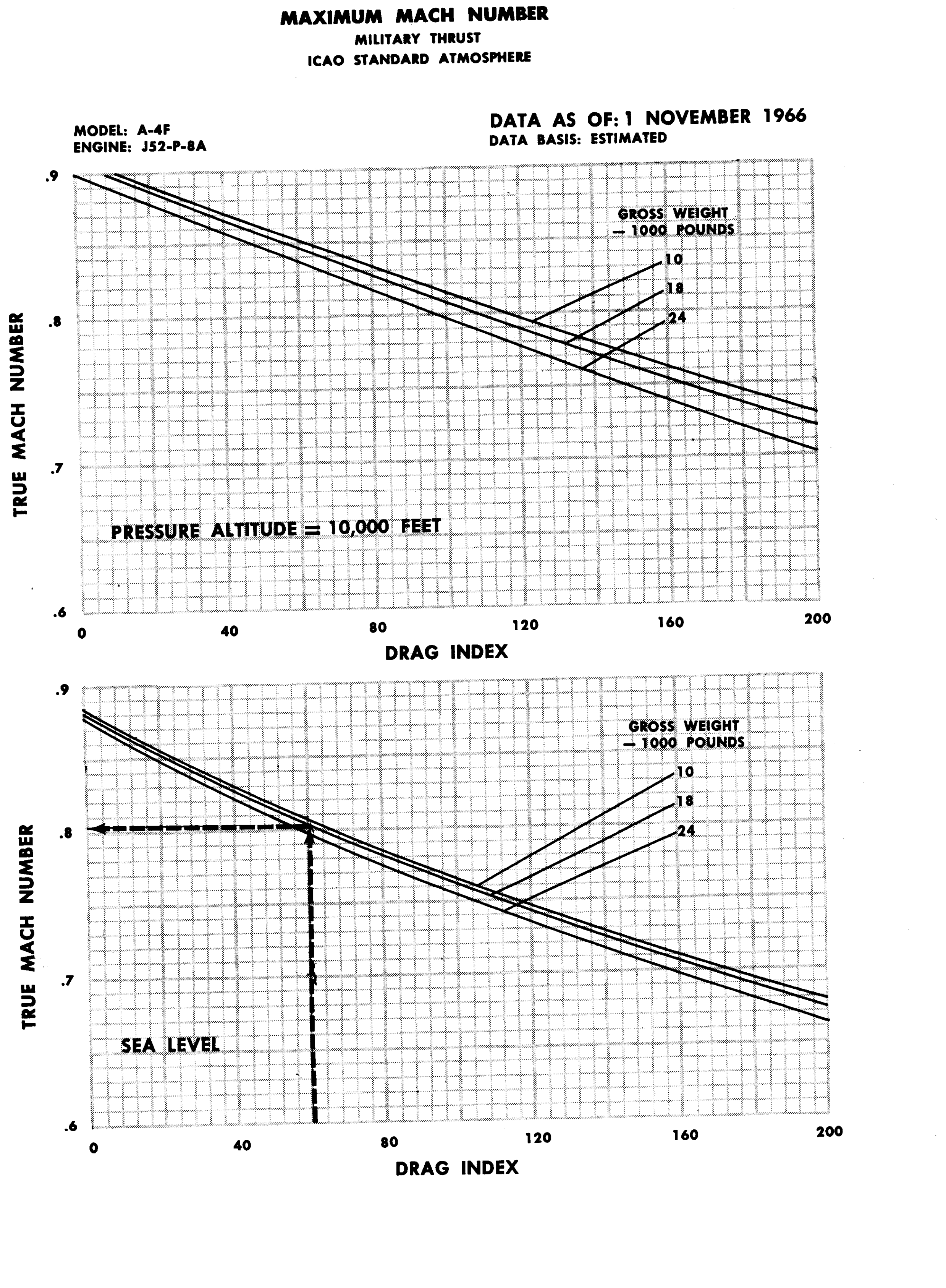


Figure 11-44. Maximum Mach Number

MILITARY FUEL FLOW
ICAO STANDARD ATMOSPHERE

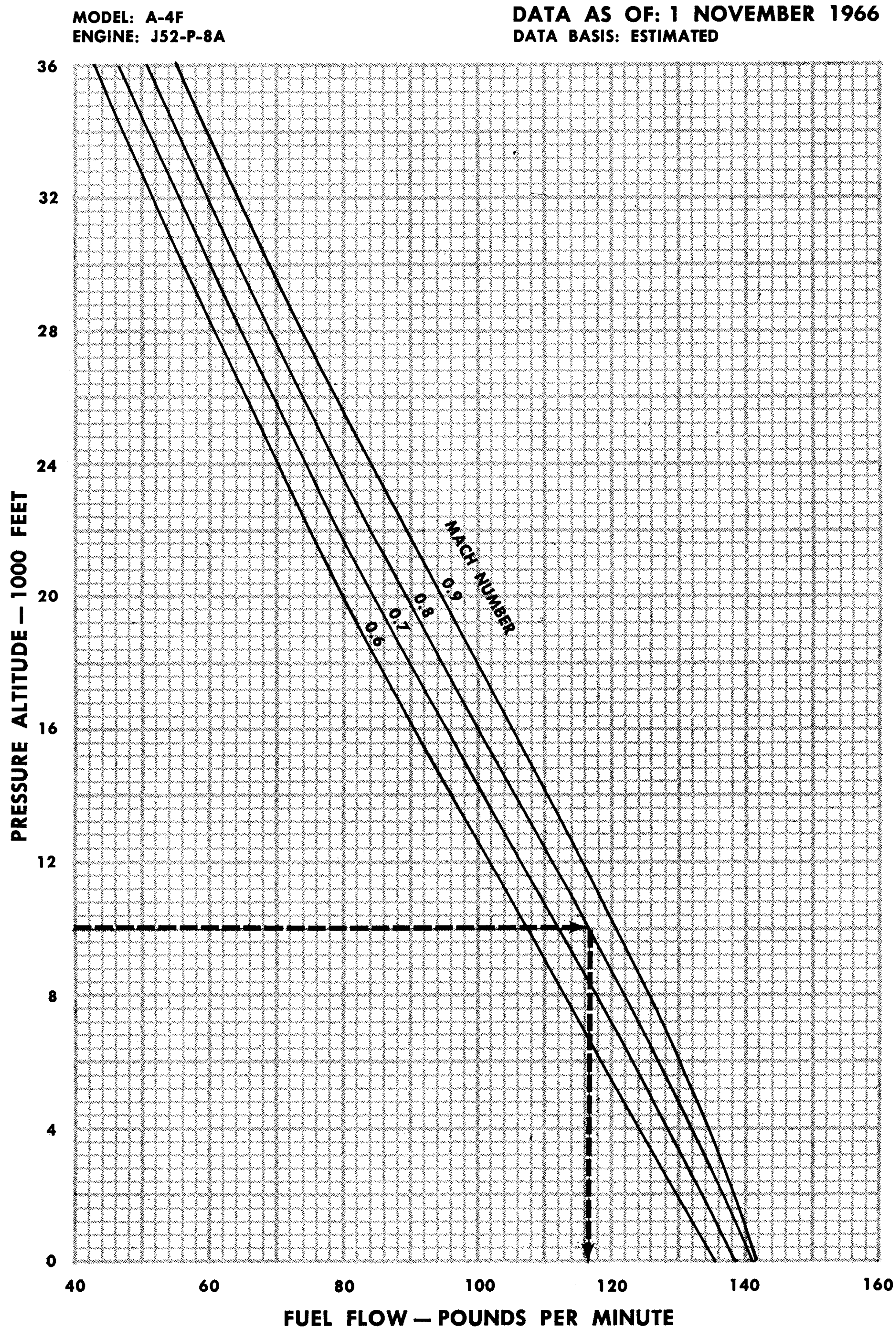


Figure 11-45. Military Fuel Flow

PART 10
MISSION PLANNING

Mission Planning

Every combat mission requires careful preflight planning to achieve maximum performance at a minimum rate of fuel consumption. The first step is to determine the maximum radius of operation from the carrier. The type of mission planned will determine the radius.

The following sample problem illustrates how the performance charts contained in Parts 1 through 9 of this section are used to plan a typical combat mission. The example is not intended to reflect an actual mission. The summary of the sample mission given is shown in figure 11-46.

SAMPLE PROBLEM

Take off and climb to 20,000 feet. Proceed on course at 20,000 feet at speed for maximum range. Descend to sea level and cruise-in for 100 nautical miles at speed for maximum range. Drop weapons store and engage in combat for 3 minutes at maximum speed. Cruise back at sea level for 100 nautical miles, then climb to optimum cruise altitude. Cruise home on course at optimum altitude and descend to sea level with 800 pounds of fuel reserve.

ASSUMPTIONS AND COMMENTS

a. Aircraft takeoff gross weight, with full fuel and store, is 23,248 pounds.

b. Aircraft zero fuel and payload weight is 11,688 pounds. Usable fuel weight is 9520 pounds. External fuel tanks are retained throughout the mission.

c. Assume zero wind and ICAO standard day conditions.

d. Assume gun ammunition is not fired during mission.

e. Assume combat allowance of 3 minutes to drop weapons store at target.

PROBLEM SOLUTION

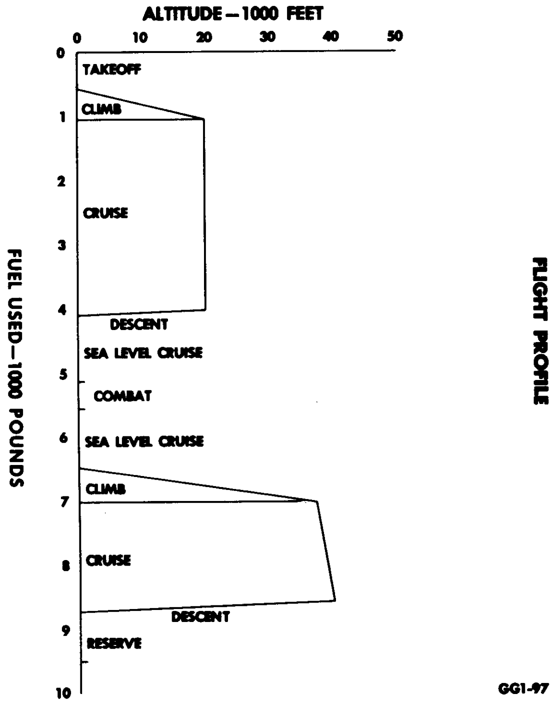
The graphical solution of the problem is introduced at this point so the pilot can see the complete picture before the actual solution is broken into parts. The problem is solved by plotting fuel remaining versus air distance. Gross weight is also shown on the vertical scale of the plots.

The first step is to derive gross weight and drag index values as follows:

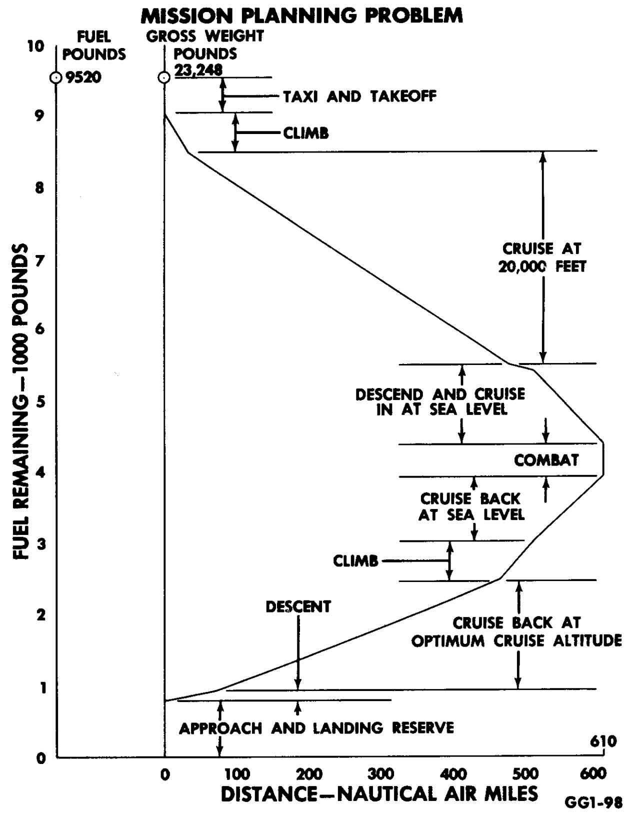
Gross Weight and Drag Indexes

(From Figure 11-1)

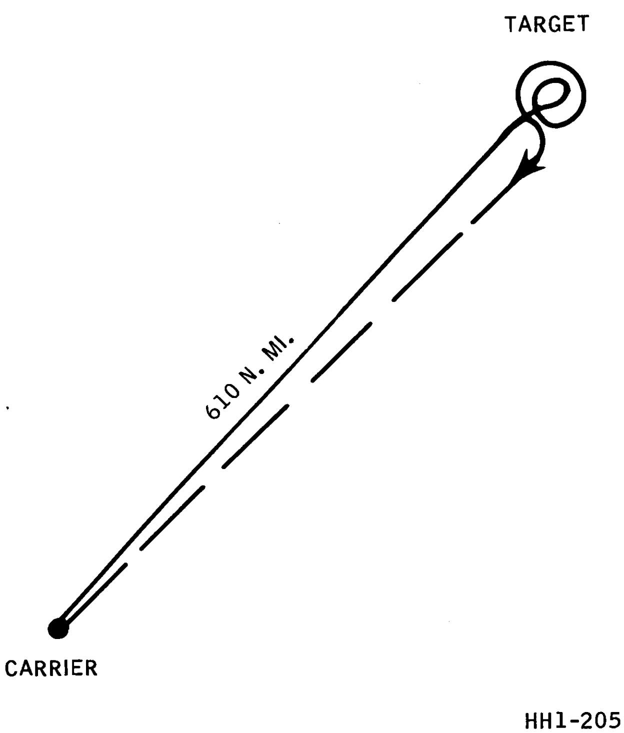
Items	Drag Index	Weight Pounds
Zero fuel, zero payload weight	0	10,537
2 MK 12 20-mm guns and ammo	6.7	460
2 Inboard wing pylons	12	136
2 Outboard wing pylons	14	124
2 300-gallon external fuel tanks	27	397
1 MK 28 store	12.2	2,040
Electronics		34
Internal fuel - 800 gallons		5,440
External fuel - 600 gallons		4,080
Takeoff total	71.9	23,248
Drop store	-12.2	-2,040
Drag index total	59.7	
Less fuel - internal		-5,440
Less fuel - external		-4,080
Total weight		11,688



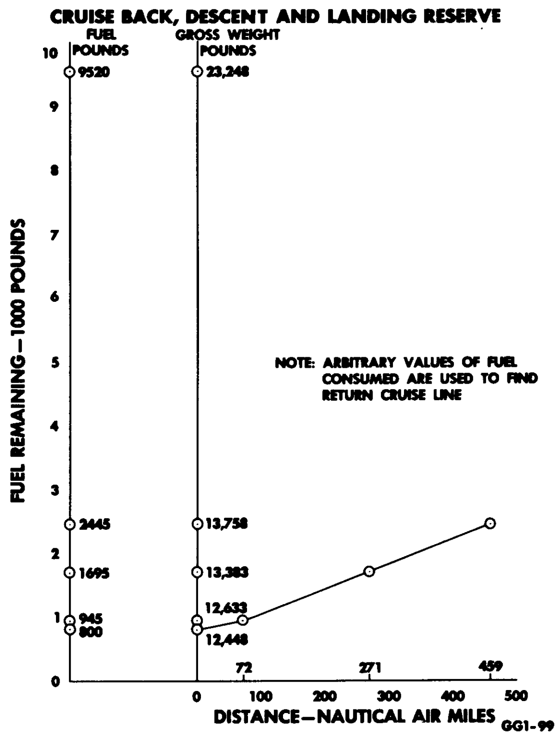
Sample Flight Profile



Sample Mission Planning Problem



Sample Plan View



Sample Cruise Back, Descent, and Landing Reserve

The mission problem is then solved in incremental steps working from takeoff through descent prior to fixed cruise at sea level and working backward from landing through combat and fixed cruise.

Start solving the mission requirements by working backward from the landing reserves. The solution follows.

APPROACH AND LANDING RESERVE ALLOWANCES. The landing reserve is assumed to be 800 pounds of fuel which will permit sea level landing pattern operation for 15 to 20 minutes.

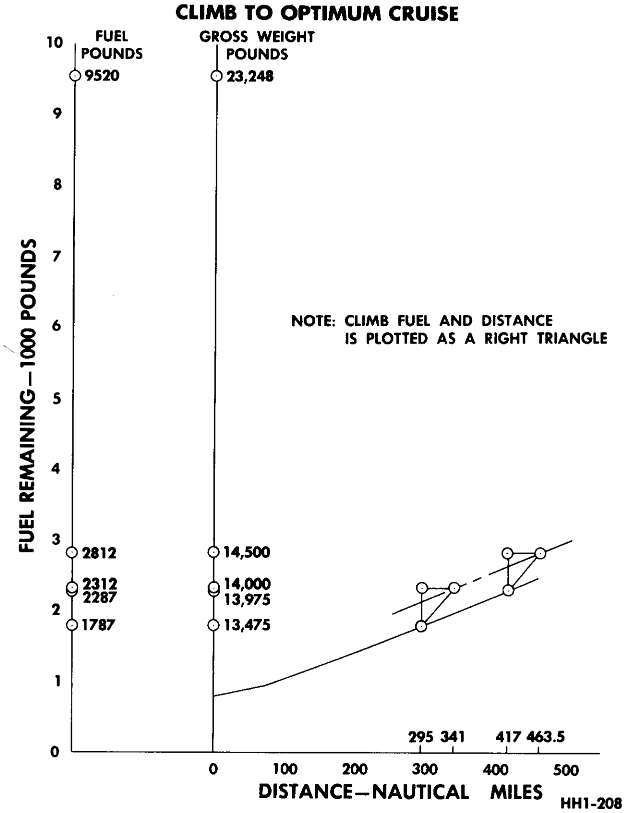
DESCENT FROM OPTIMUM CRUISE ALTITUDE TO SEA LEVEL. The time, fuel, and descent distance can be determined from the descent figures (figures 11-37 through 11-39 and 11-76 through 11-78). The drag index for this configuration is 59.7 with two 300-gallon external fuel tanks retained. Assume the gross weight at the beginning of the letdown is equal to the gross weight with reserve fuel (12,488 pounds = 11,688 pounds + 800 pounds). The optimum cruise altitude for this weight and drag index is read from figures 11-20 and 11-60.

Weight (Pounds)	Optimum Cruise Altitude (Feet)	Fuel (Pounds)	Time (Minutes)	Distance (Nmi)
12,488	39,900	145	17.0	72

RETURN AT OPTIMUM CRUISE ALTITUDE. The optimum cruise altitude fuel requirements can be determined from figures 11-27 and 11-66. The drag index is 59.7 and the gross weight at end of cruise is 12,633 pounds (11,688 + 800 + 145). Assume arbitrary cruise fuel increments and construct the return fuel-distance line as shown on the graph.

Fuel Increment (Pounds)	Average Weight (Pounds)	Optimum Cruise Altitude (Feet)	Optimum Cruise Mach Number
750	13,008	39,000	0.715
750	13,758	37,900	0.715

Nmi/Pound of Fuel	Distance Increment (Nmi)	Fuel Flow	EPR
0.265	199	1550	2.42
0.251	188	1620	2.42

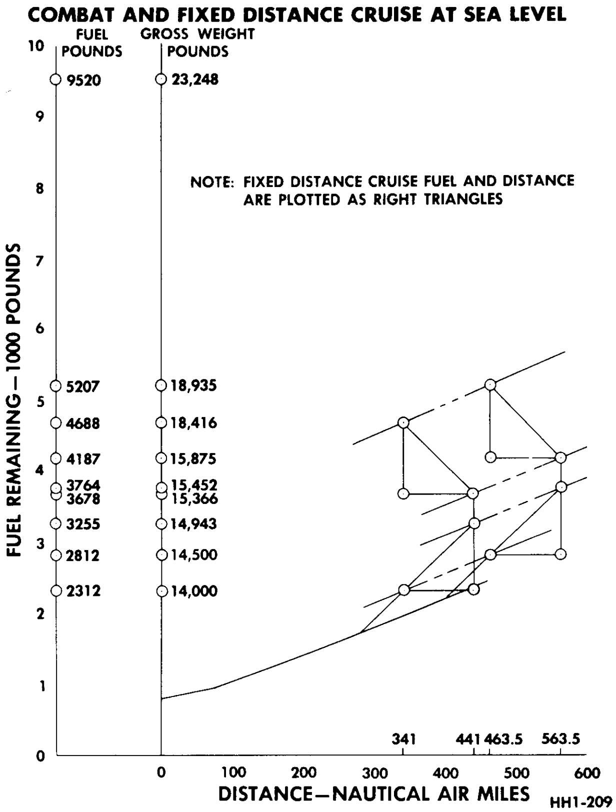


Sample Climb to Optimum Cruise

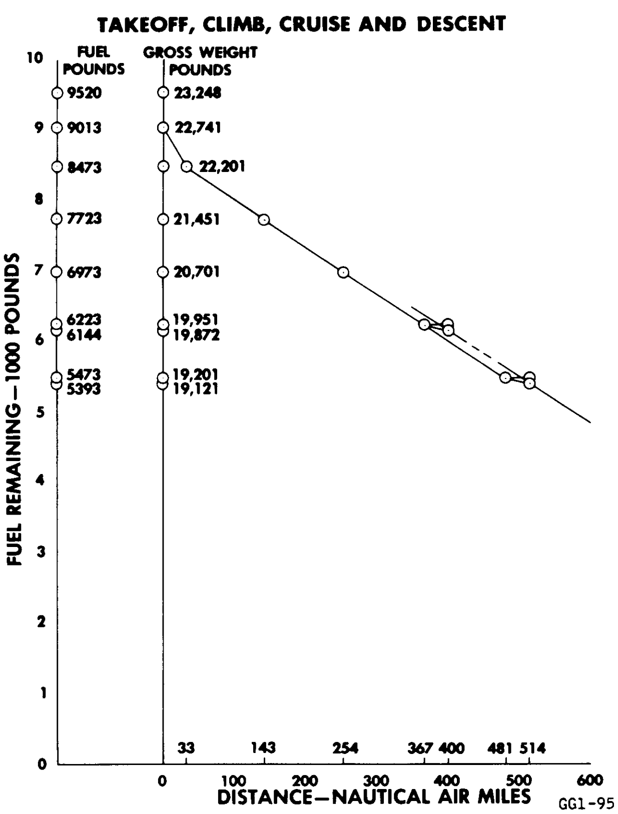
CLIMB TO OPTIMUM CRUISE ALTITUDE. The time, fuel, and climb distances can be determined from figures 11-17 through 11-19 and 11-57 through 11-59. Assume two arbitrary initial climb weights of 14,500 and 14,000 pounds and read the values at drag index of 59.7. Construct right triangle fuel-distance lines on the graph beginning at the appropriate fuel consumed values corresponding to weights of 14,500 and 14,000 pounds, minus fuel consumed in climb.

Initial Weight (Pounds)	Fuel (Pounds)	Distance (Nmi)	Time (Minutes)
14,500	535	46.5	7.1
14,000	525	46.0	7.0

FIXED DISTANCE CRUISE-BACK AT SEA LEVEL. Assume the two arbitrary initial climb weights as weights at end of 100-nautical mile cruise at sea level. Using figures 11-25, 11-26, 11-64 and 11-65, read nautical miles per pound values at drag index



Sample Combat and Fixed Distant Cruise at Sea Level



Sample Takeoff, Climb, Cruise, and Descent

of 59.7. Solve fuel required for 100 nautical miles. Construct right triangle distance-fuel lines beginning at appropriate fuel consumed values corresponding to weights of 14,000 and 14,500 pounds.

Distance (Nmi)	End of Cruise Weight (Pounds)	Nmi/Pound of Fuel	Fuel (Pounds)
100	14,000	0.106	943
100	14,500	0.105	952

COMBAT. A 3-minute sea level maximum speed combat allowance is assumed to drop the MK 28 store over the target. To permit a conservative fuel allowance, it is assumed the store has been dropped prior to combat and the drag index is 59.7. The variation in maximum speed with aircraft gross weight, at sea level, is negligible. Therefore, assume a gross weight of 18,000 pounds. Read the maximum Mach number of 0.802 from figures 11-44 and 11-83 and the fuel flow at that Mach number, of 141 pounds per minute from figures 11-45 and 11-84. Assume no distance covered during combat and plot these values on the graph.

FIXED DISTANCE CRUISE-OUT AT SEA LEVEL. Repeat the same operation as for cruise-back at sea level portion except for adding on weight and drag for the store to the weights used at start of combat. Use drag index of 71.9 and end of cruise weights of 17,406 pounds (14,000 + 943 + 423 + 2040) and 17,915 pounds (14,500 + 952 + 423 + 2040).

Distance (Nmi)	End of Cruise Weight (Pounds)	Nmi/Pound of Fuel	Fuel (Pounds)
100	17,406	0.99	1010
100	17,915	0.98	1020

TAXI, TAKEOFF, AND ACCELERATION. The first portion of the graph was constructed working backwards. The remainder of the plot can be developed starting at the taxi, takeoff condition. Takeoff gross weight is 23,248 pounds with a corresponding drag index of 71.9. Assume that 507 pounds of fuel will be used for warmup, taxi, takeoff, and acceleration allowances.

CLIMB TO 20,000-FOOT CRUISE ALTITUDE. The time, fuel, and distance to climb values were read from figures 11-17 through 11-19 and 11-57 through 11-59 at a drag index of 71.9 and an initial climb weight of 22,741 pounds (23,248 - 507).

Initial Weight (Pounds)	Fuel (Pounds)	Distance (Nmi)	Time (Minutes)
22,741	540	33	5.4

CRUISE-OUT AT 20,000-FOOT ALTITUDE. The initial cruise-out weight is 22,201 pounds (22,741 - 540) and the drag index remains at 71.9. Assume arbitrary cruise fuel increments, and construct the cruise-out line on the graph, using values from figures 11-25, 11-26, 11-64, and 11-65.

Initial Weight (Pounds)	Fuel Increment (Pounds)	Average Weight (Pounds)	Nmi/ Pound of Fuel	Distance Increment (Nmi)
22,201	750	21,826	0.146	110
21,451	750	21,076	0.148	111
20,701	750	20,326	1.150	113
19,951	750	19,576	1.152	114

DESCENT FROM 20,000 FEET TO SEA LEVEL. The time, fuel, and distance to descent are found from figures 11-37 through 11-39 and 11-76 through 11-78. Using a drag index of 71.9 and two initial weights, construct right triangle distance-fuel lines on the graph.

Initial Weight (Pounds)	Fuel (Pounds)	Distance (Nmi)	Time (Minutes)
19,951	79	32	7.5
19,201	80	32	7.8

Final radius distance is determined by the intersection of line connecting points at beginning of fixed distance cruise-out at sea level with line connecting points at end of descent, and adding fixed cruise-out distance to intersection point.

Takeoff and Landing Data Card

Certain takeoff and landing performance items can be entered on the data card for convenient reference. Entries on the sample takeoff and landing data card are from the sample mission problem.

	Initial Weight ~lb	Fuel ~lb	Time ~Min	Distance ~Nmi	
Takeoff	23,248	507	---	---	
Climb to 20,000 ft	22,741	540	5.4	38	Climb Speed (Alt-1000 ft / KCAS): 0 / 335; 10 / 320; 20 / 305
Cruise at 20,000 ft	22,201	2974	69.5	445	Cruise Speed-KCAS: 285; EPR: 2.04; Fuel Flow lb/hr: 2570
Descent to Sea Level	19,227	82	7.9	32	Descent Speed-KCAS: 230
Cruise at Sea Level	19,145	1030	20.8	100	Cruise Speed-KCAS: 290; EPR: 1.52; Fuel Flow lb/hr: 2970
Combat at Sea Level	16,075	423	3.0	0	MACH No.: 0.802; Fuel Flow-lb/hr: 8460
Cruise at Sea Level	15,652	930	22.4	100	Cruise Speed-KCAS: 270; EPR: 1.49; Fuel Flow lb/hr: 2490
Climb to Opt Alt (37,200 Feet)	14,722	550	7.2	45	Climb Speed (Alt-1000 ft / KCAS-MACH No.): 0 / 340; 10 / 325; 20 / 310; 30 / 0.74; 40 / 0.74
Cruise-back at Opt Alt (Final Alt = 39,900 ft)	14,172	1539	57.5	393	Cruise Speed-KCAS: 220; EPR: 2.42; Fuel Flow lb/hr: 1610
Descent to Sea Level	12,633	145	17.0	72	Descent Speed-KCAS: 185
Approach and Landing Reserve	12,488	800	---	---	
Basic Weight Totals	11,688	9520	210.7	1220	

Figure 11-46. Summary of Sample Mission

TAKEOFF AND LANDING DATA CARD

CONDITIONS	
Gross Weight	23, 248 LB
Runway Length	9000 FT
Runway Temperature	+20° C
Pressure Altitude	2000 FT
Runway Wind Component	10 KN
Runway Gradient	-2 PERCENT
TAKEOFF	
Acceleration Check	108 KN, 2000 FT
Takeoff Speed	161 KCAS
Ground Run	5050 FT
Total Distance to Clear 50-Foot Obstacle	7650 FT
Refusal Speed	
Stopping Distance	
CONDITIONS	
Gross Weight	12, 488 LB
Runway Length	8000 FT
Runway Temperature	10° C
Pressure Altitude	3000 FT
Flap Deflection	FULL
Runway Wind Component	5 KN
Braking Coefficient	WET CONCRETE
Runway Gradient	-2 PERCENT
LANDING	
Approach Angle-of-Attack	17.5 UNITS
Final Approach Speed	123 KIAS
Touchdown Speed	123 KIAS
Landing Ground Roll	3400 FT
Distance Over 50-Foot Obstacle	4115 FT

Figure 11-47. Takeoff and Landing Data Card

PART 2A
TAKEOFF

MODEL: A-4E
ENGINE: J52-P-6A

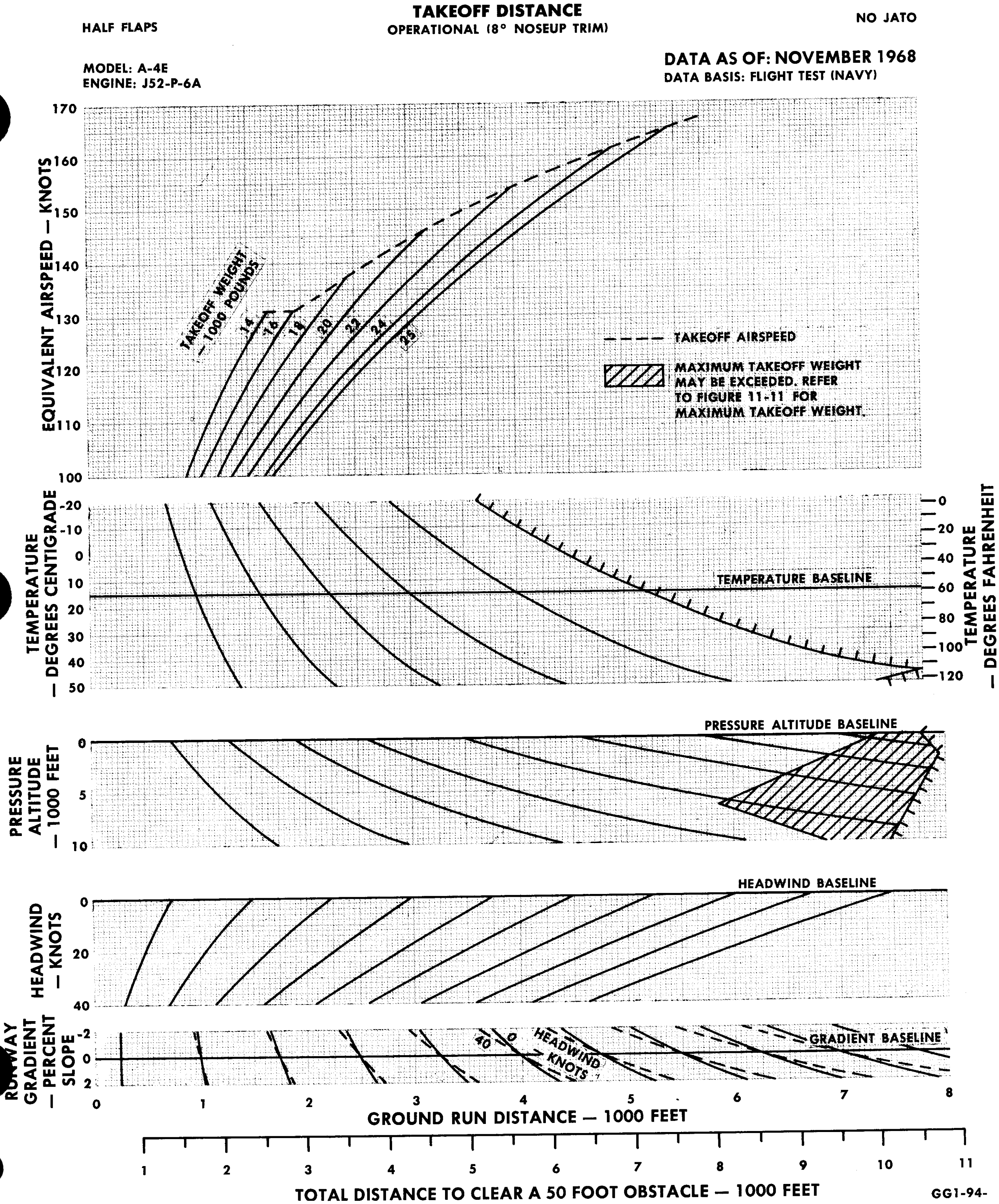


Figure 11-49. Takeoff Distance

MAXIMUM TAKEOFF WEIGHT

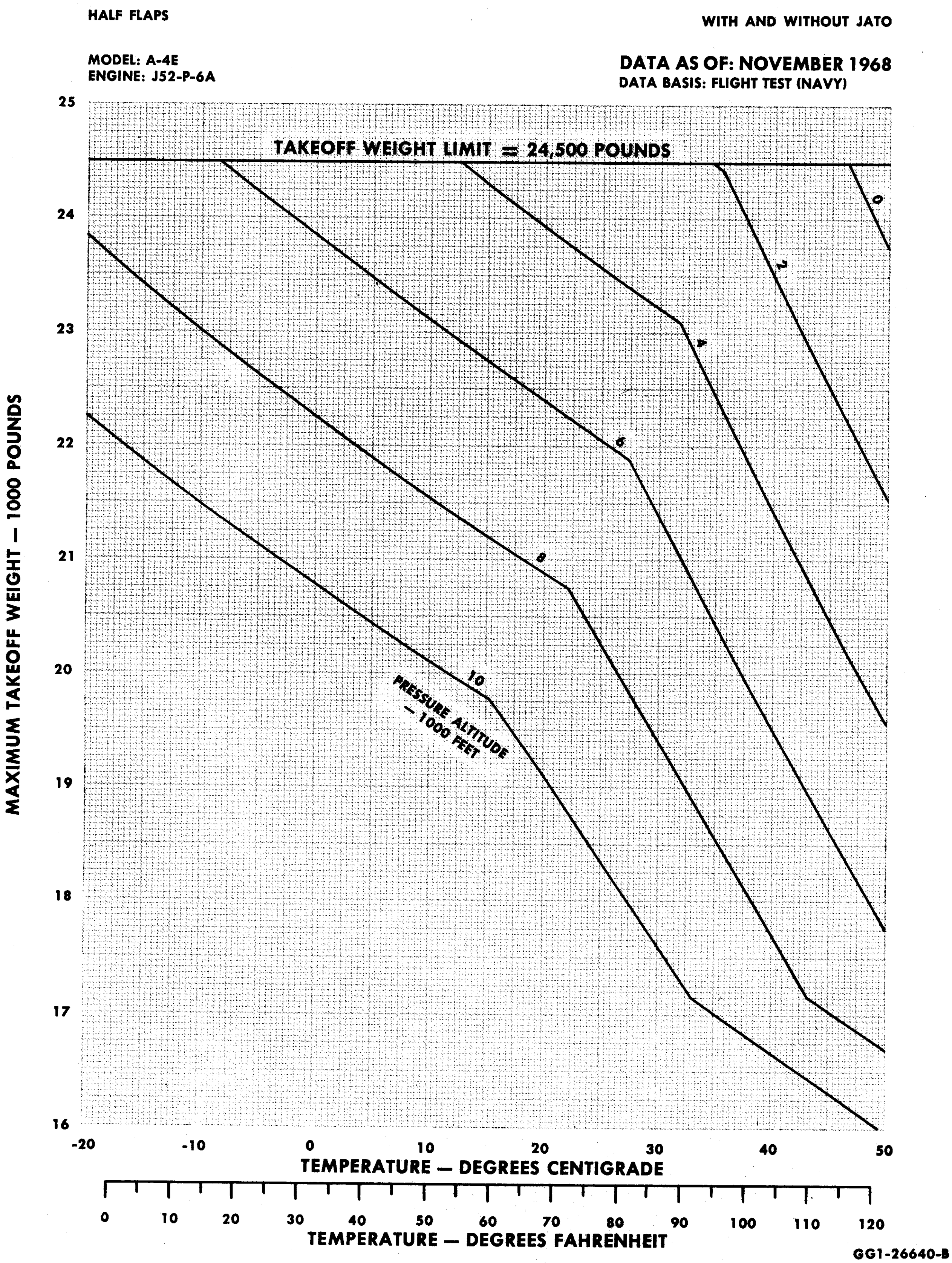


Figure 11-50. Maximum Takeoff Weight

JATO FIRING DELAY

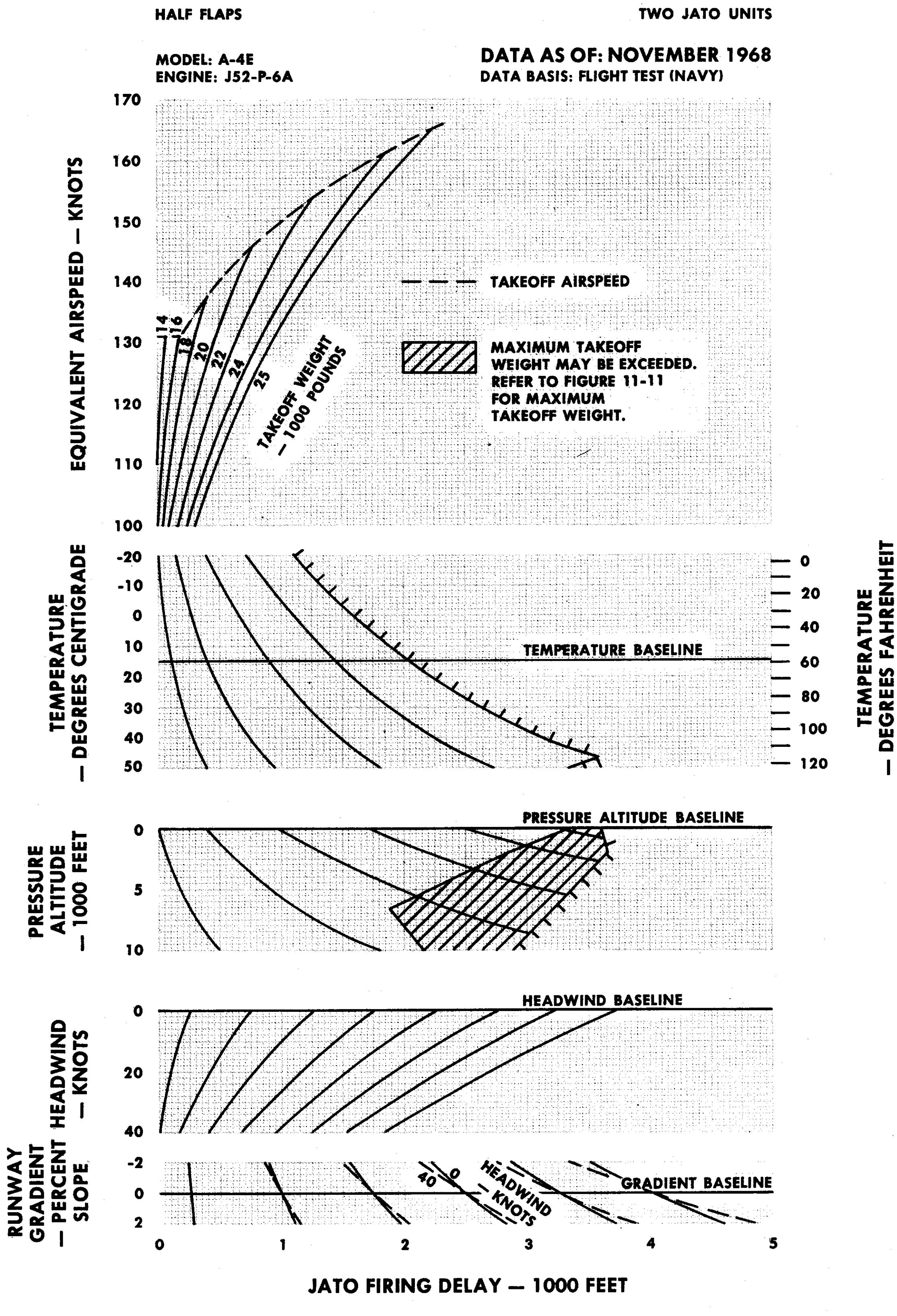


Figure 11-51. JATO Firing Delay

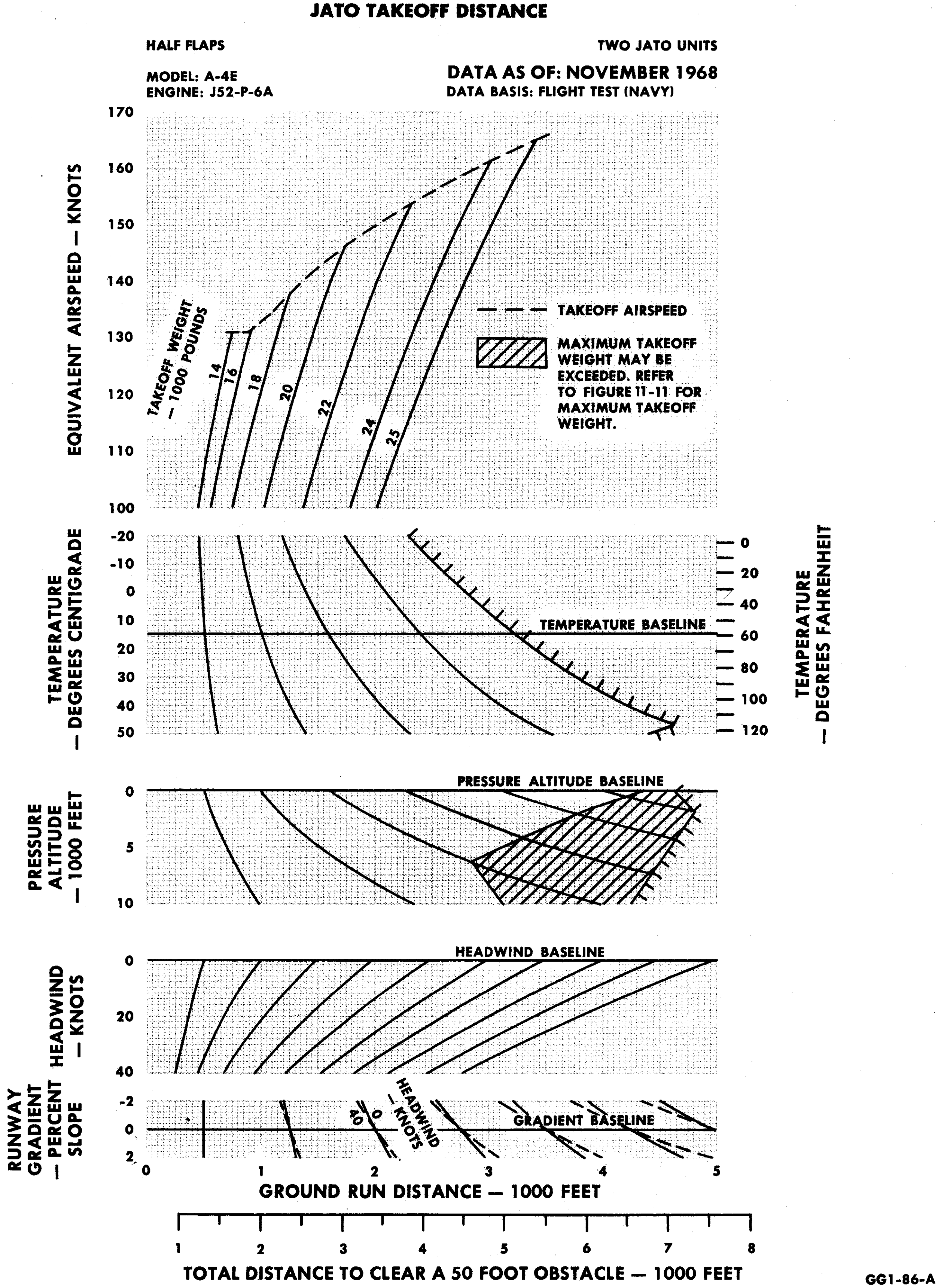


Figure 11-52. JATO Takeoff Distance

NEW

TAKEOFF REFUSAL SPEED
HALF FLAPS
SPOILERS OPEN

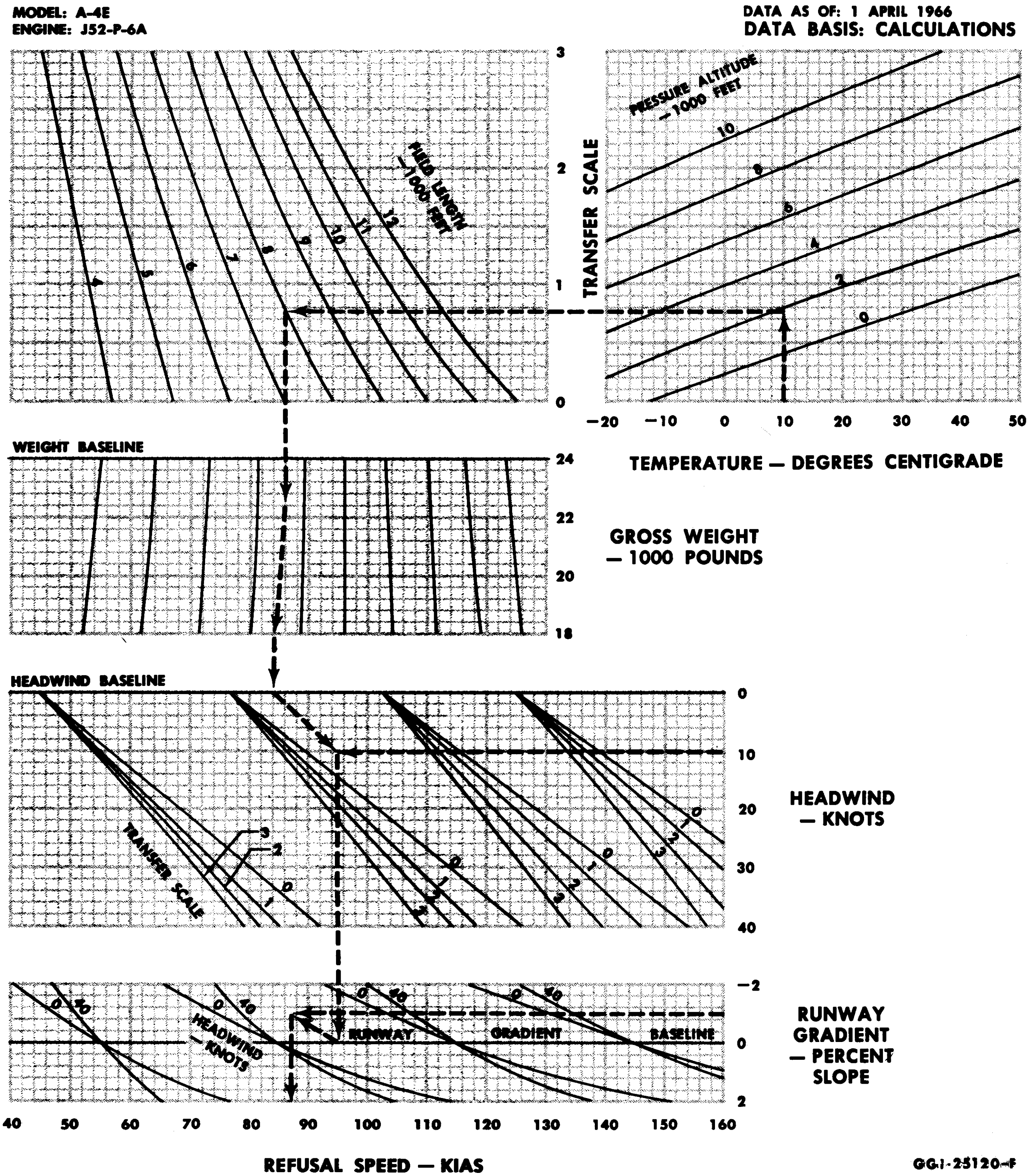


Figure 11-53. Takeoff Refusal Speeds (Sheet 1)

NEW

TAKEOFF REFUSAL SPEEDS
HALF FLAPS
SPEEDBRAKES OPEN
SPOILERS OPEN

MODEL: A-4E
ENGINE: J52-P-6A

DATA AS OF: 1 MARCH, 1970
DATA BASIS: ESTIMATED

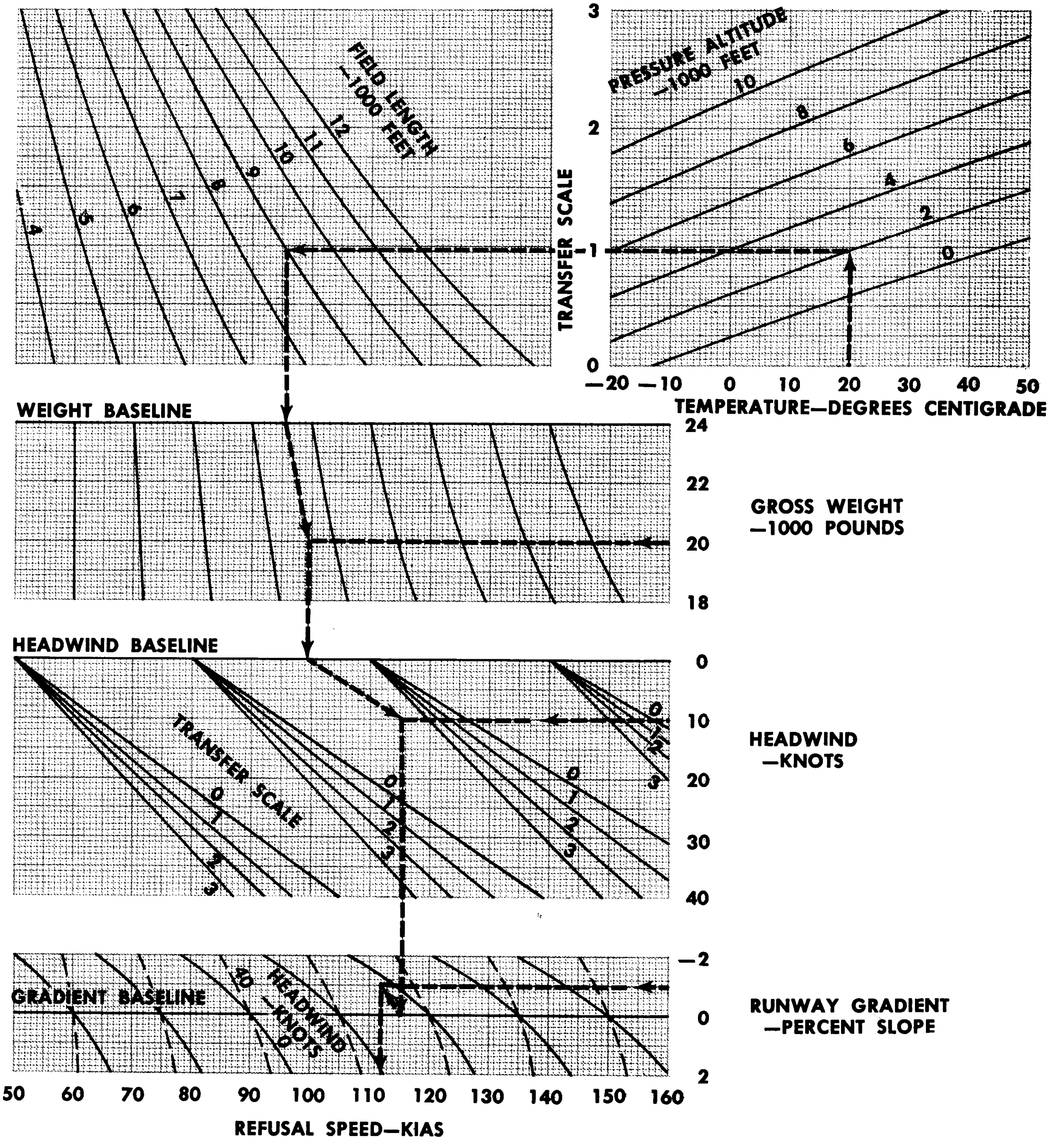


Figure 11-53. Takeoff Refusal Speeds (Sheet 2)

BRAKE APPLICATION SPEED
HALF FLAPS

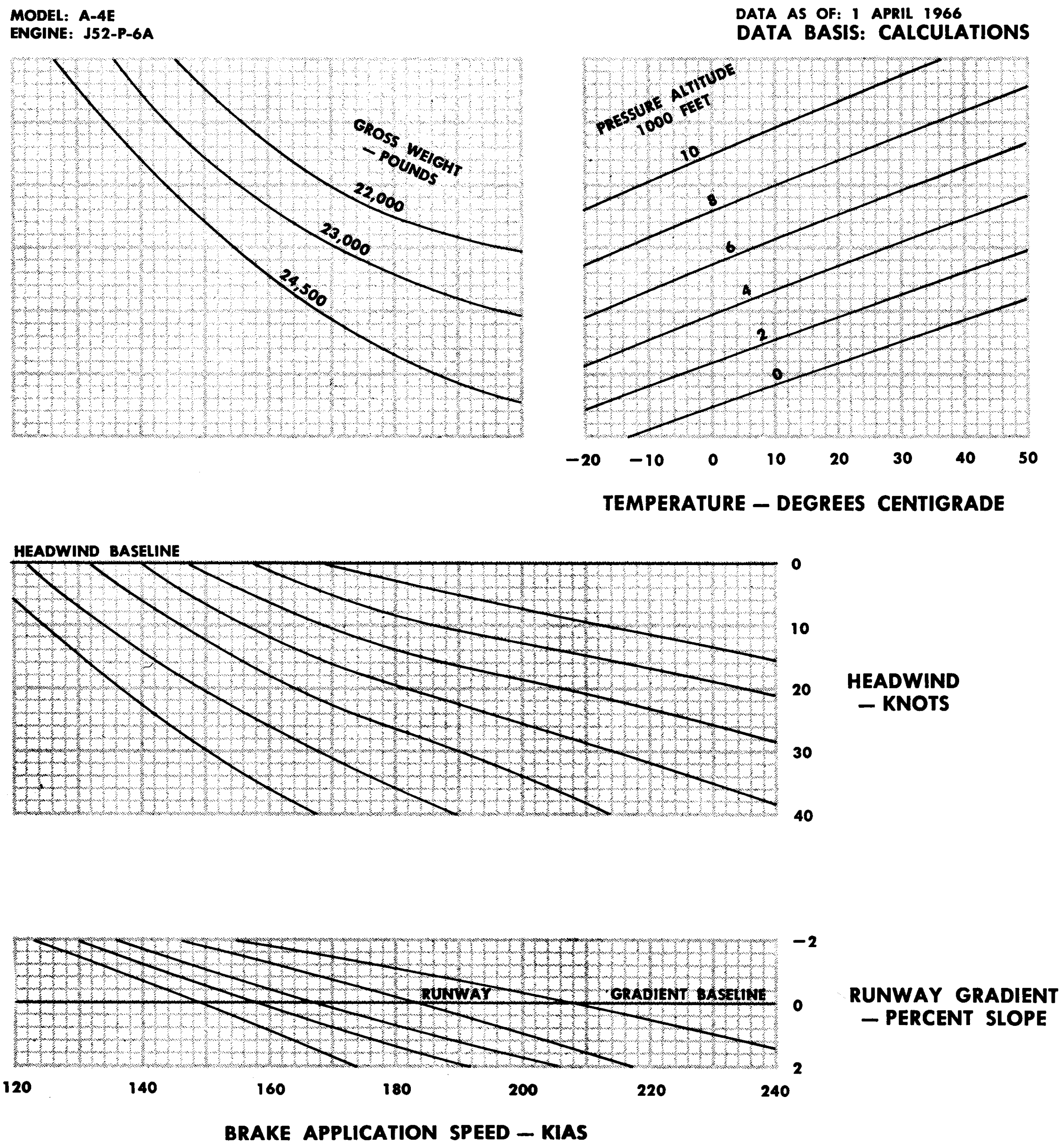


Figure 11-54. Brake Application Speed

STOPPING DISTANCE
AFTER BRAKE APPLICATION
HALF FLAPS

MODEL: A-4E
ENGINE: J52-P-6A

DATA AS OF: 1 APRIL 1966
DATA BASIS: CALCULATIONS

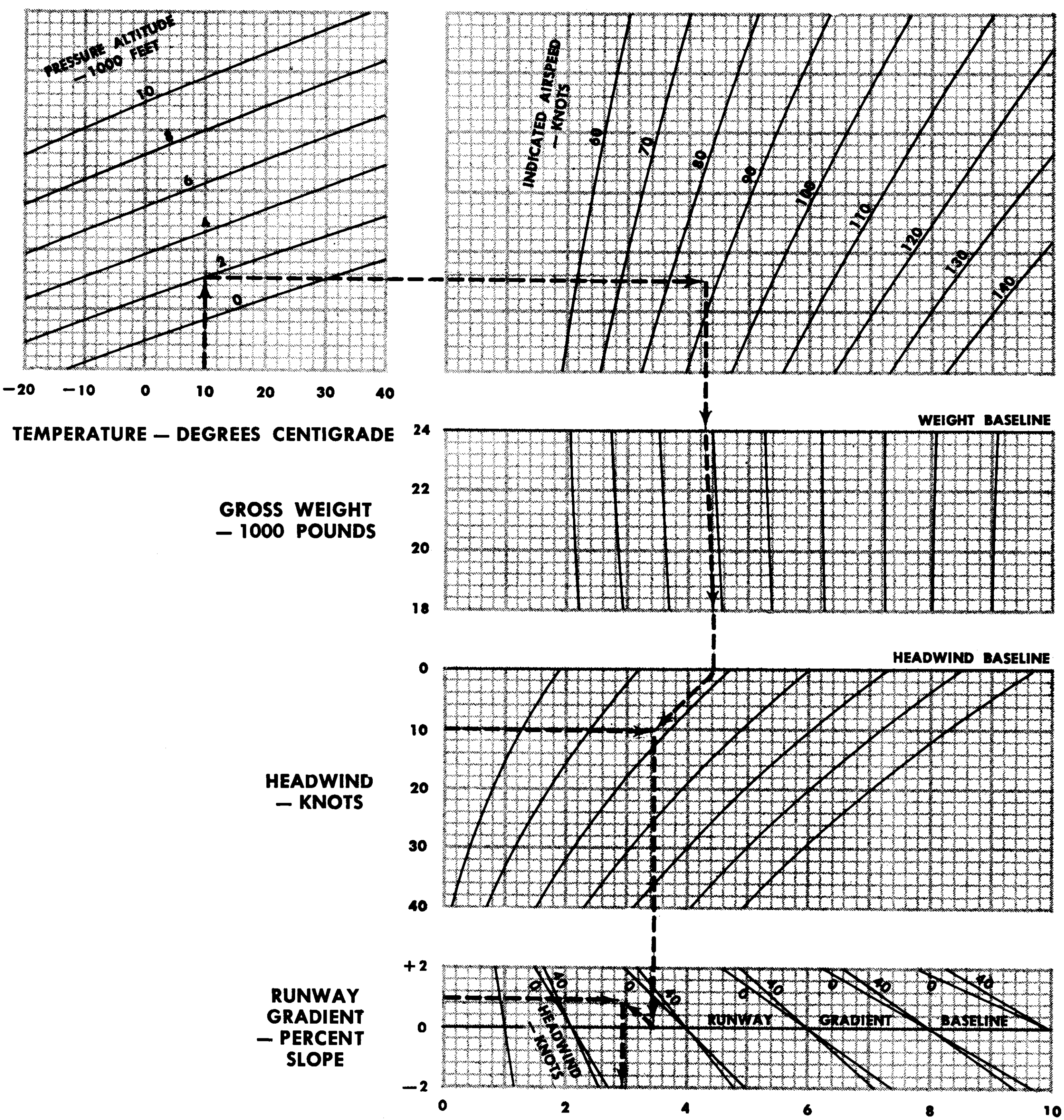


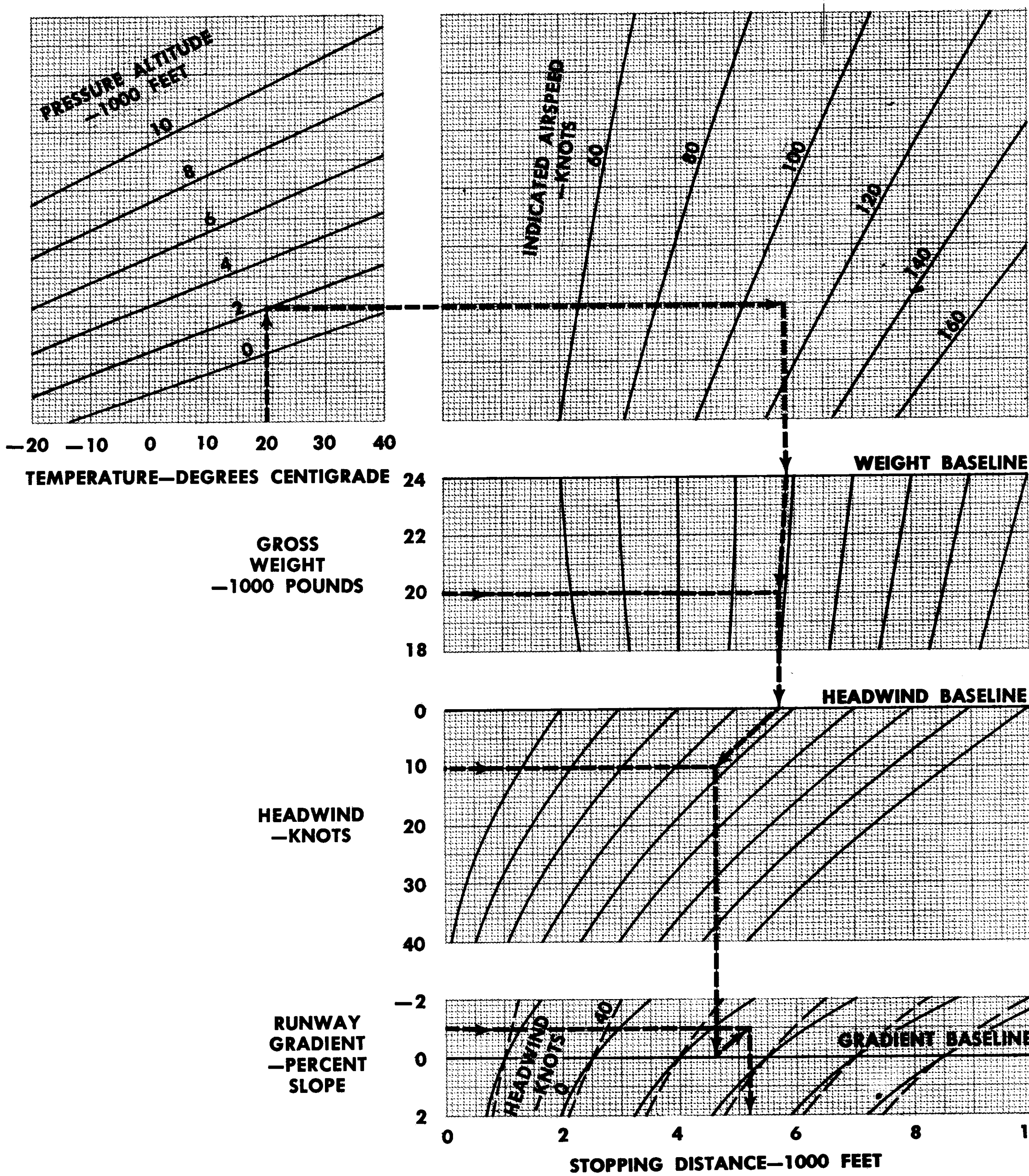
Figure 11-55. Stopping Distance (Sheet 1)

STOPPING DISTANCE

HALF FLAPS
SPEEDBRAKES OPEN
SPOILERS OPEN

MODEL: A-4E
ENGINE: J52-P-6A

DATA AS OF: 1 MARCH, 1970
DATA BASIS: ESTIMATED

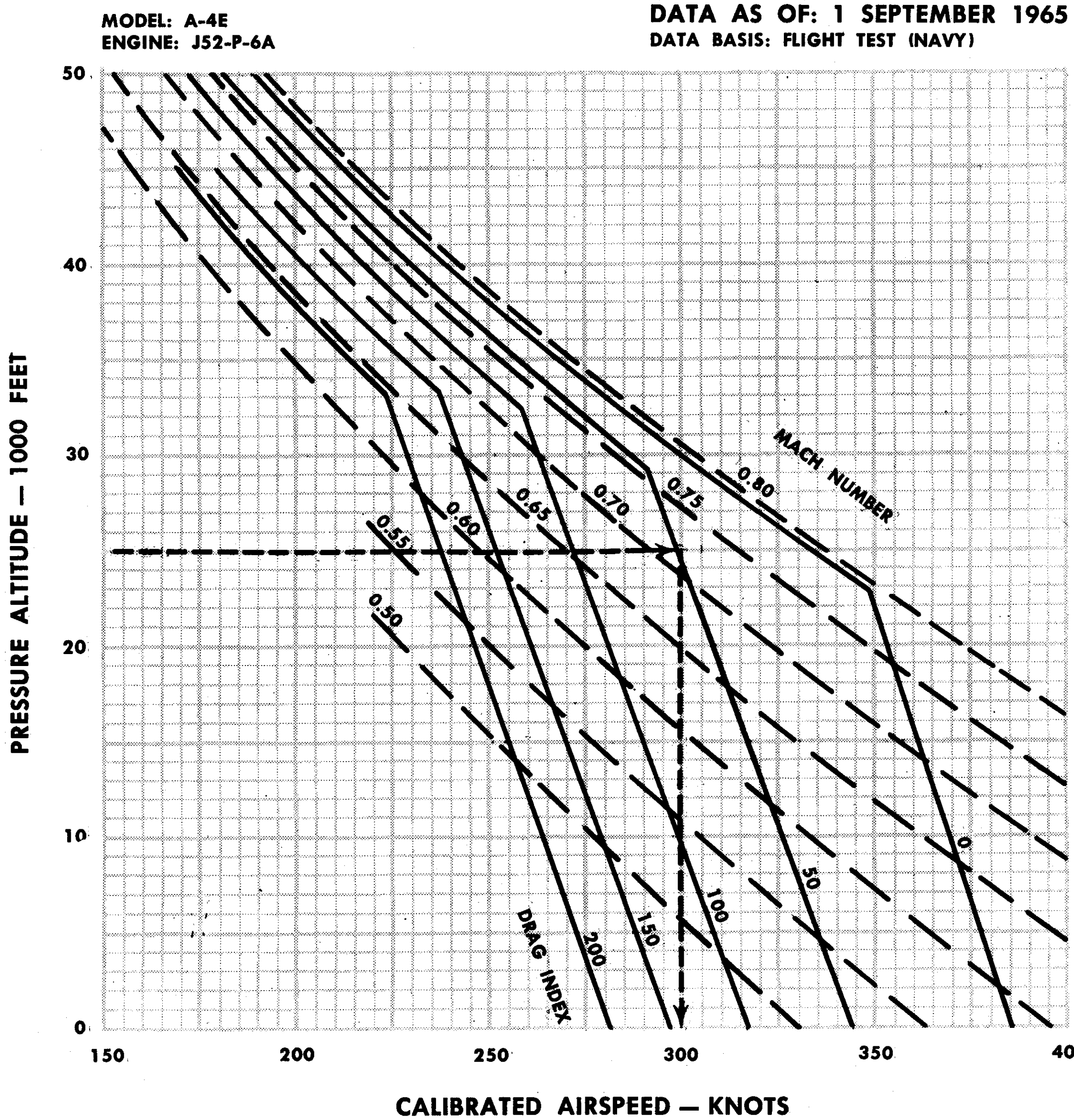


GG1-121

Figure 11-55. Stopping Distance (Sheet 2)

PART 3A
CLIMB

CLIMB SPEED SCHEDULE
MILITARY THRUST



TAKEOFF AND ACCELERATION TO CLIMB SPEED ALLOWANCES

	BRAKE RELEASE TO CLIMB SPEED				
DRAG INDEX	0	50	100	150	200
FUEL — LB	120	140	160	200	
TIME — MIN	1.0	1.2	1.4	1.7	

GROUND TAXI FUEL FLOW = 15 LB/MIN

P-25122-1A

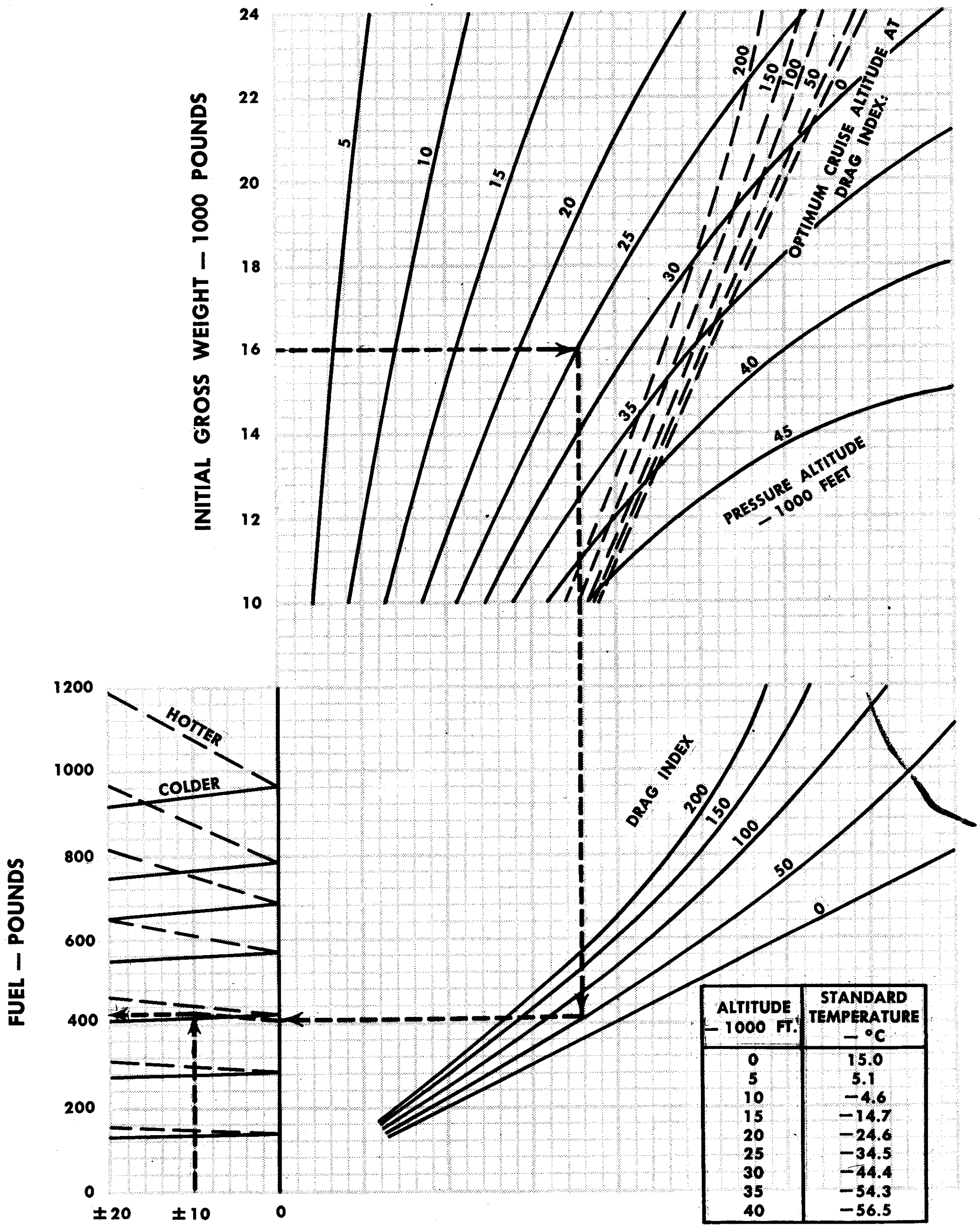
Figure 11-56. Climb Speed Schedule

CLIMB FUEL

MILITARY THRUST

MODEL: A-4E
ENGINE: J52-P-6A

DATA AS OF: 1 SEPTEMBER 1965
DATA BASIS: FLIGHT TEST (NAVY)



ALTITUDE — 1000 FT.	STANDARD TEMPERATURE — °C
0	15.0
5	5.1
10	−4.6
15	−14.7
20	−24.6
25	−34.5
30	−44.4
35	−54.3
40	−56.5

P-40534-1

Figure 11-57. Climb Fuel

CLIMB DISTANCE

MILITARY THRUST

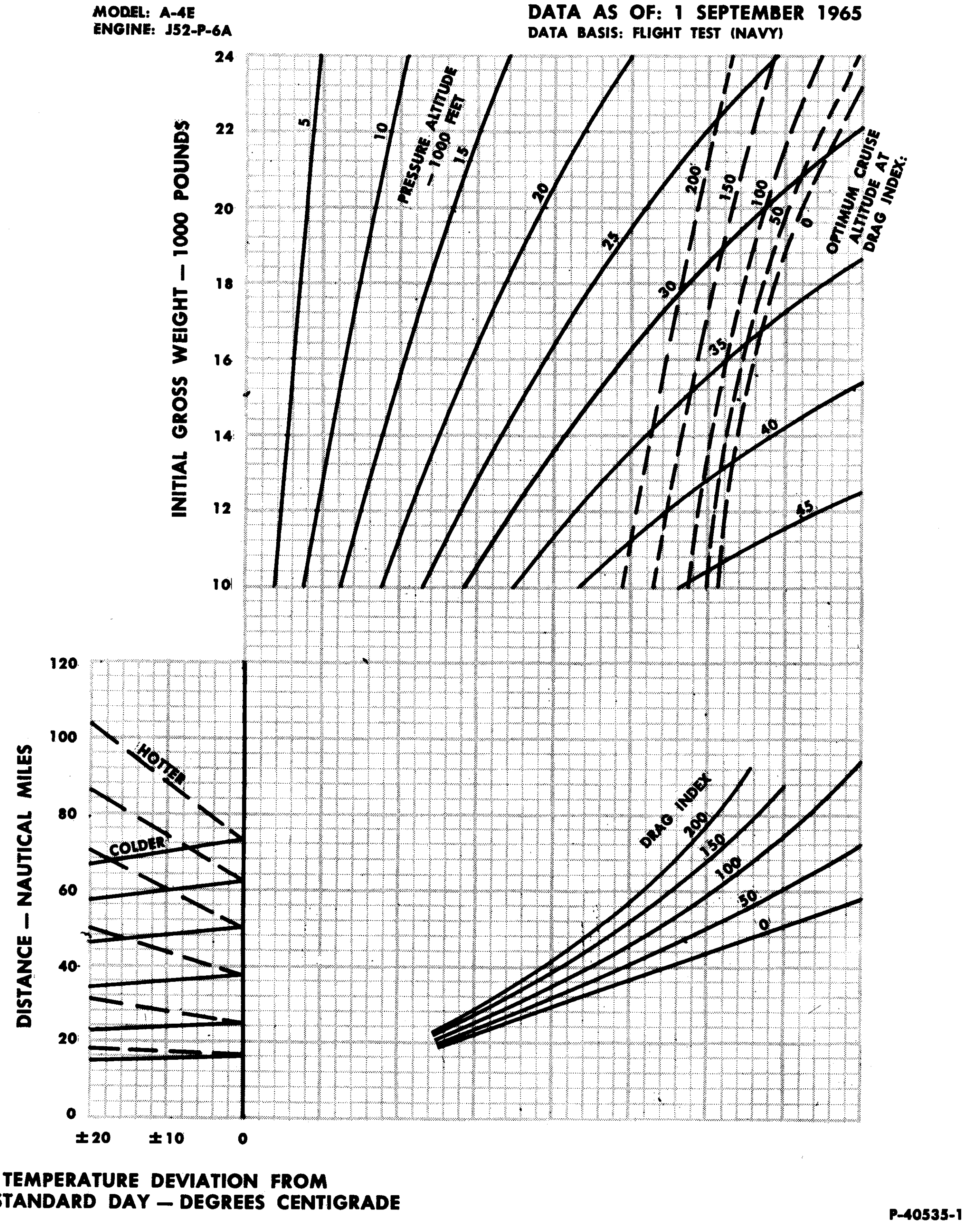
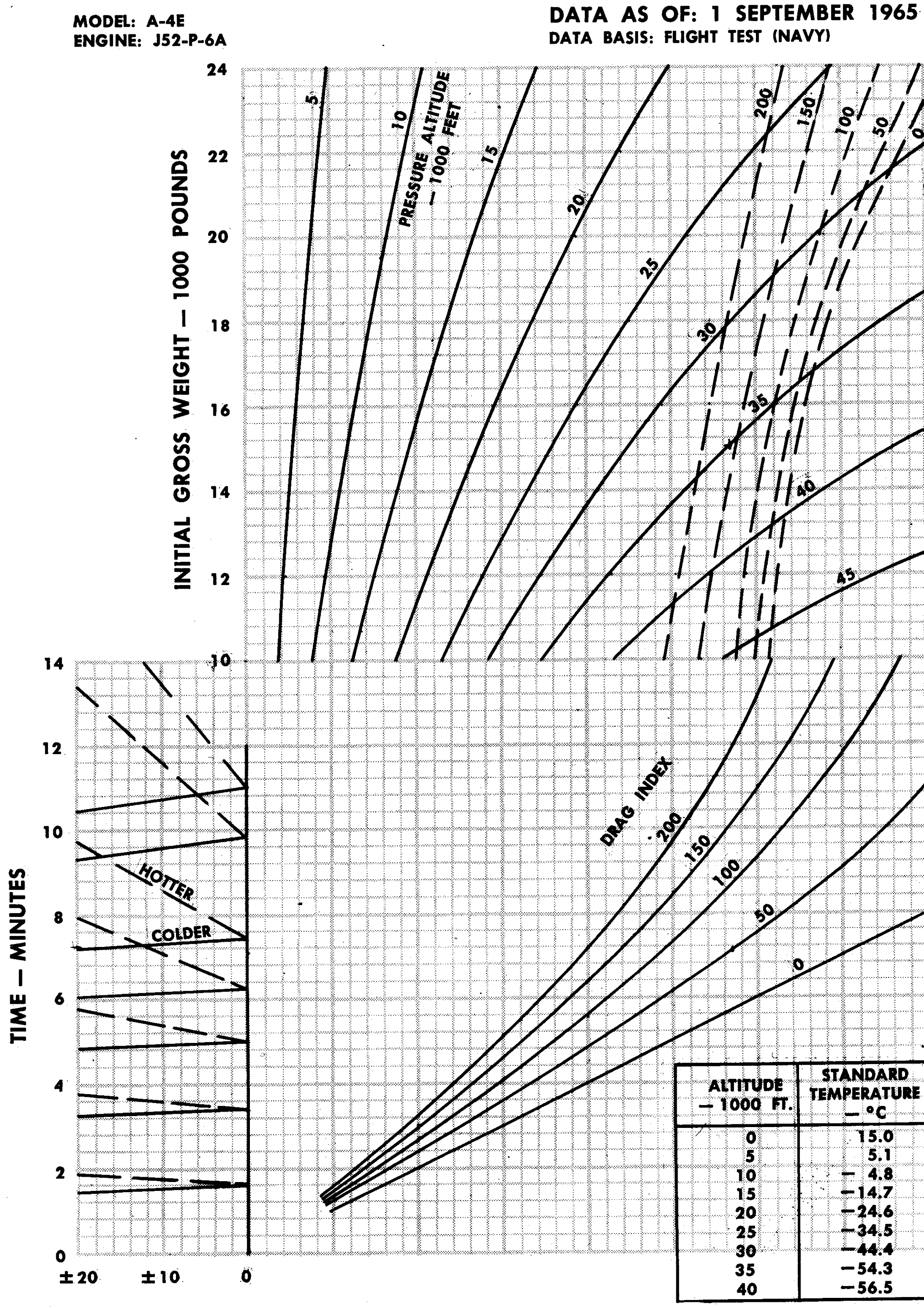


Figure 11-58. Climb Distance

CLIMB TIME
MILITARY THRUST



ALTITUDE — 1000 FT.	STANDARD TEMPERATURE — °C
0	15.0
5	5.1
10	− 4.8
15	−14.7
20	−24.6
25	−34.5
30	−44.4
35	−54.3
40	−56.5

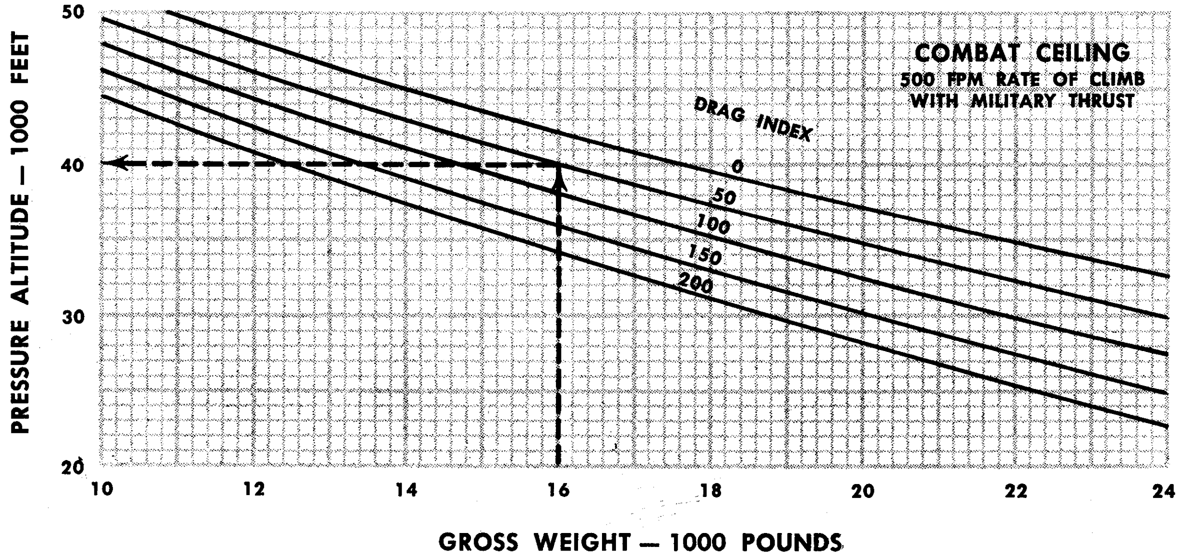
P-40536-1

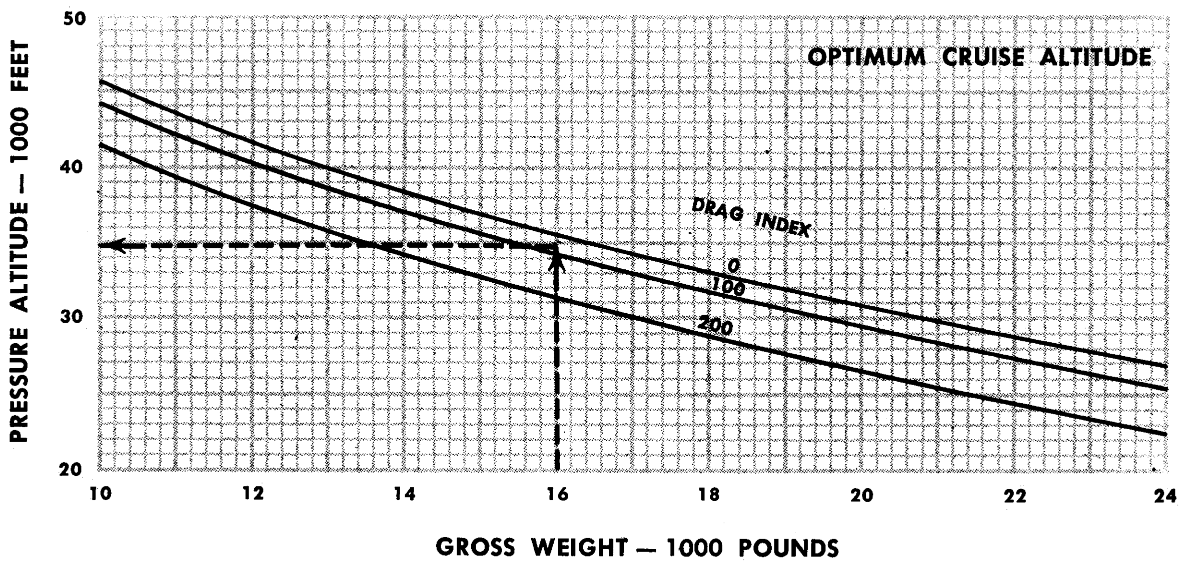
Figure 11-59. Climb Time

COMBAT CEILING AND OPTIMUM CRUISE ALTITUDE
ICAO STANDARD ATMOSPHERE

MODEL: A-4E
ENGINE: J52-P-6A

DATA AS OF: 1 SEPTEMBER 1965
DATA BASIS: FLIGHT TEST (NAVY)





P-40538-1

Figure 11-60. Combat Ceiling and Optimum Cruise Altitude

PART 4A
RANGE

FOULED DECK RANGE

Drag Index = 33
Aircraft Weight (Less Fuel) = 11,044 Pounds
Five Pylons and Guns
Includes 250 Pounds Reserve Fuel For Landing

Model: A-4E
Engine: J52-P-6A

Data as of: 1 September 1965
Data Basis: Flight Test (Navy)

FUEL ON BOARD – POUNDS	IF YOU ARE AT SEA LEVEL				IF YOU ARE AT 10,000 FEET				IF YOU ARE AT 20,000 FEET			
	Range At Sea Level	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 10,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 20,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude
	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots
2300	242	40,000	566	220	332	40,000	594	220	436	40,000	621	220
1900	195	40,000	453	215	270	40,000	477	220	359	40,000	505	220
1700	173	40,000	393	215	239	40,000	420	220	320	40,000	448	220
1500	149	40,000	334	215	208	40,000	361	215	279	40,000	387	215
1300	125	40,000	274	215	177	40,000	298	215	239	40,000	328	215
1100	101	40,000	212	215	145	40,000	237	215	197	40,000	266	215
900	77	40,000	150	215	114	40,000	177	215	155	40,000	203	215
700	54	30,000	89	225	82	40,000	116	215	114	40,000	139	215
500	30	15,000	44	240	50	20,000	58	235	72	30,000	78	225

FUEL ON BOARD – POUNDS	IF YOU ARE AT 30,000 FEET				IF YOU ARE AT 35,000 FEET				IF YOU ARE AT 40,000 FEET			
	Range At 30,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 35,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 40,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude
	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots
2300	566	40,000	641	220	621	40,000	650	220	657	40,000	657	220
1900	464	40,000	525	220	512	40,000	536	220	545	40,000	545	220
1700	413	40,000	467	220	456	40,000	477	220	486	40,000	486	220
1500	360	40,000	408	220	398	40,000	419	220	426	40,000	426	220
1300	309	40,000	347	215	340	40,000	358	215	367	40,000	367	220
1100	256	40,000	284	215	283	40,000	296	215	304	40,000	304	215
900	202	40,000	223	215	223	40,000	233	215	243	40,000	243	215
700	148	40,000	161	215	164	40,000	170	215	180	40,000	180	215
500	94	35,000	97	220	104	40,000	107	215	116	40,000	116	215

Pressure Altitude	Climb Speed Military Thrust		Descent Speed Engine Idle – Speedbrakes Closed	Start Letdown From Altitude With Fuel Remaining
Feet	KCAS	Mach No.	KCAS	Pounds
Sea Level	335		180	250
10,000	340		180	315
20,000	320		180	350
30,000		0.77	180	375
35,000		0.77	180	390
40,000		0.77	180	400

Figure 11-61. Fouled Deck Range

BINGO RANGE CHART

Aircraft Weight (Less Fuel) = 11,458 Pounds
Five Pylons, Guns, and 2 300-Gallon External Tanks
Drag Index = 60
Includes 800 Pounds Reserve Fuel For Landing

Model: A-4E
Engine: J52-P-6A

Data as of: 1 September 1965
Data Basis: Flight Test (Navy)

FUEL ON BOARD – POUNDS	IF YOU ARE AT SEA LEVEL				IF YOU ARE AT 10,000 FEET				IF YOU ARE AT 20,000 FEET			
	Range At Sea Level	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 10,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 20,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude
	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots
2700	209	40,000	450	220	284	40,000	477	220	424	40,000	501	220
2500	187	40,000	400	220	256	40,000	426	220	339	40,000	452	220
2300	165	40,000	351	220	227	40,000	376	220	304	40,000	401	220
2100	143	40,000	298	220	119	40,000	324	220	265	40,000	350	220
1900	121	40,000	247	215	170	40,000	273	220	228	40,000	298	220
1700	100	40,000	195	215	141	40,000	205	215	191	40,000	246	215
1500	78	40,000	143	215	112	40,000	153	215	153	40,000	195	215
1300	56	30,000	90	230	83	20,000	104	235	116	40,000	139	215
1100	34	15,000	48	240	54	20,000	66	235	78	30,000	81	225

FUEL ON BOARD – POUNDS	IF YOU ARE AT 30,000 FEET				IF YOU ARE AT 35,000 FEET				IF YOU ARE AT 40,000 FEET			
	Range At 30,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 35,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range Ft 40,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude
	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots
2700	476	40,000	522	220	518	40,000	530	220	527	40,000	527	220
2500	429	40,000	474	220	469	40,000	481	220	489	40,000	489	220
2300	384	40,000	422	220	420	40,000	431	220	438	40,000	438	220
2100	338	40,000	370	215	371	40,000	379	220	388	40,000	388	220
1900	290	40,000	321	215	320	40,000	328	215	336	40,000	336	215
1700	244	40,000	269	215	269	40,000	276	215	284	40,000	284	215
1500	197	40,000	215	215	217	40,000	225	215	231	40,000	231	215
1300	149	40,000	159	215	165	40,000	168	215	177	40,000	177	215
1100	100	40,000	109	215	112	40,000	118	215	122	40,000	122	215

Pressure Altitude	Climb Speed Military Thrust		Descent Speed Engine Idle – Speedbrakes Closed	Start Letdown From Altitude With Fuel Remaining
Feet	KCAS	Mach No.	KCAS	Pounds
Sea Level	340		180	800
10,000	320		180	860
20,000	300		180	890
30,000		0.75	180	915
35,000		0.75	180	925
40,000		0.75	180	935

Figure 11-62. Bingo Range Chart

LONG RANGE CRUISE

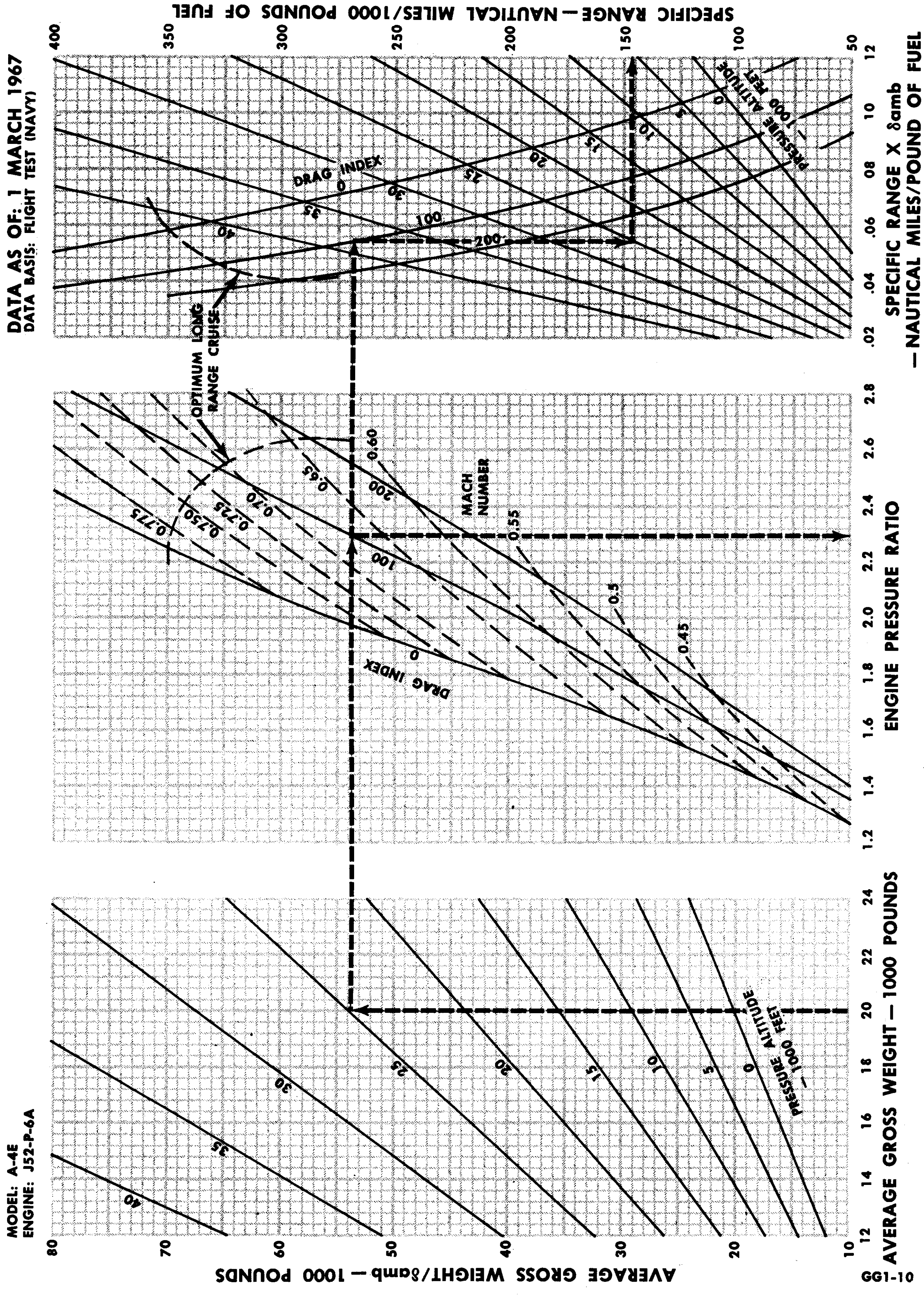


Figure 11-63. Long Range Cruise

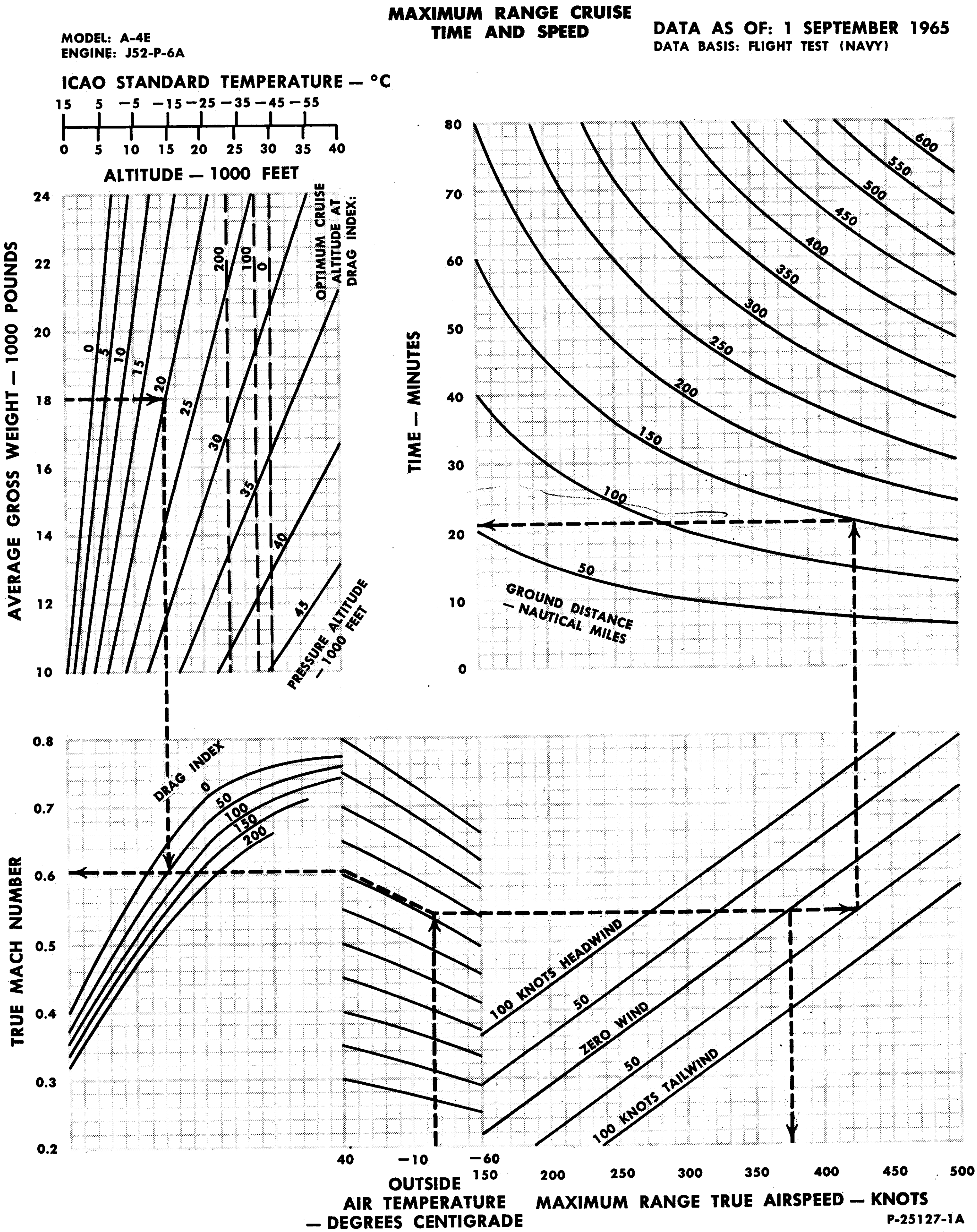


Figure 11-64. Maximum Range Cruise — Time and Speed

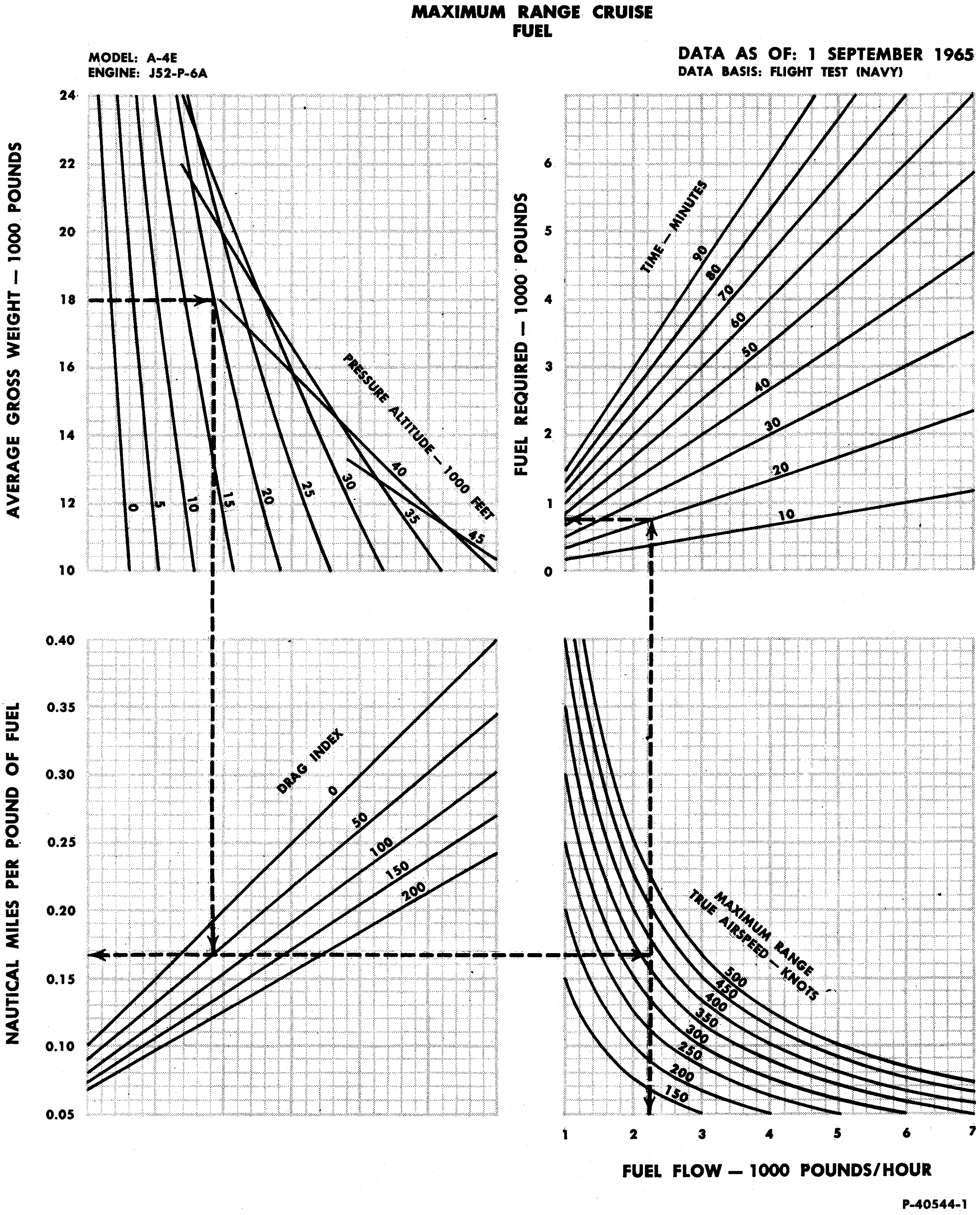


Figure 11-65. Maximum Range Cruise — Fuel

NAUTICAL MILES PER POUND OF FUEL

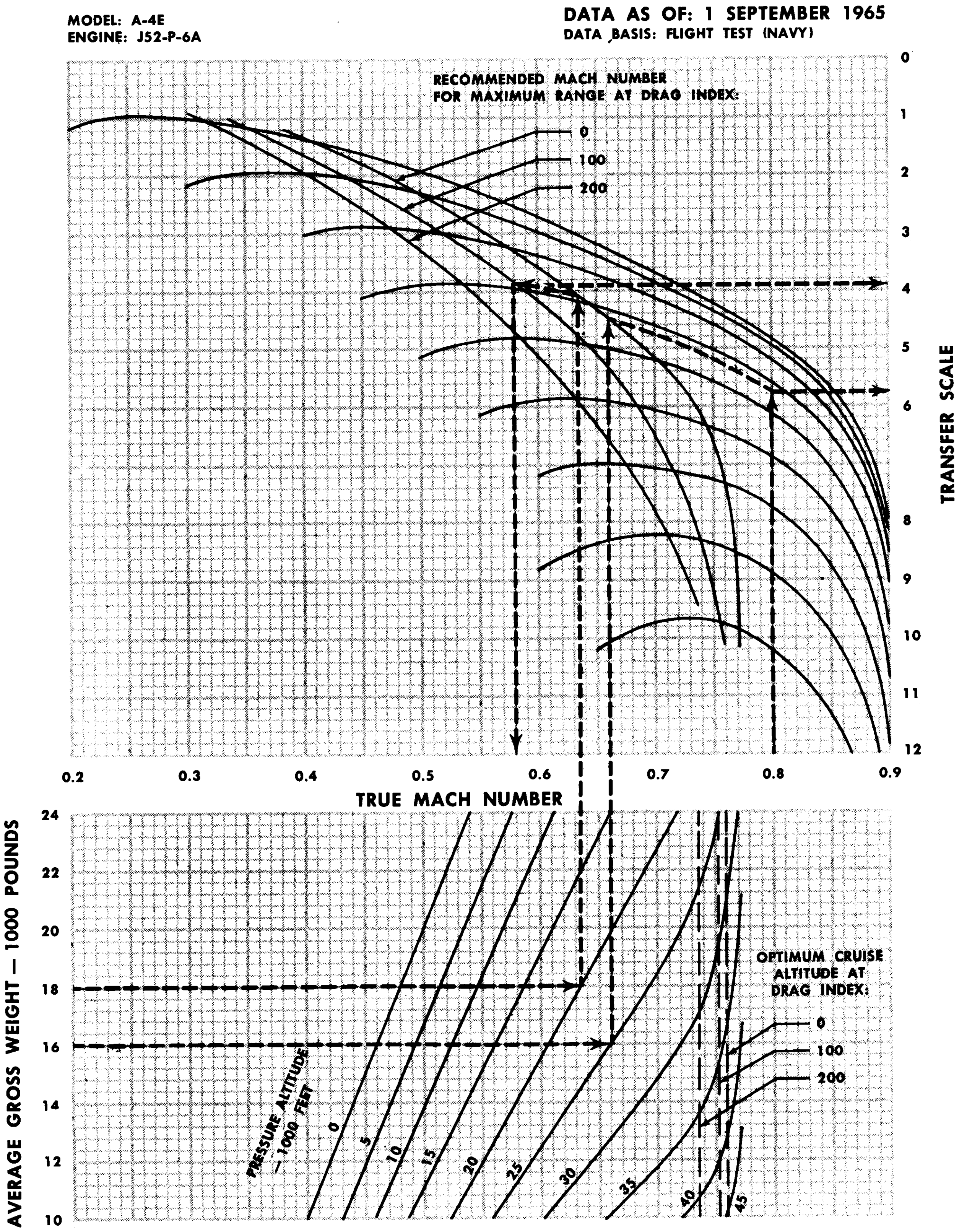
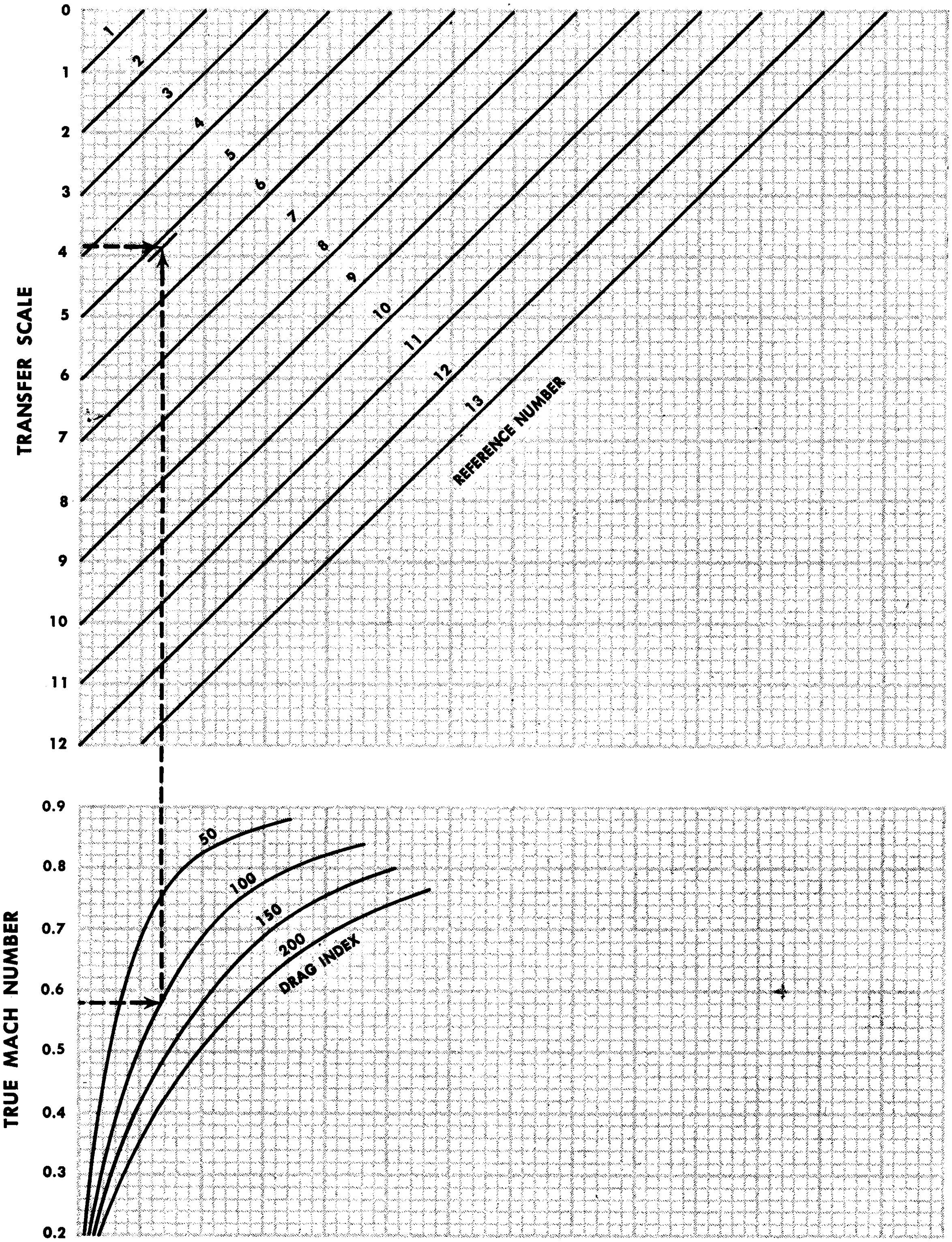


Figure 11-66. Nautical Miles per Pound of Fuel (Sheet 1)

NAUTICAL MILES PER POUND OF FUEL

MODEL: A-4E
ENGINE: J52-P-6A

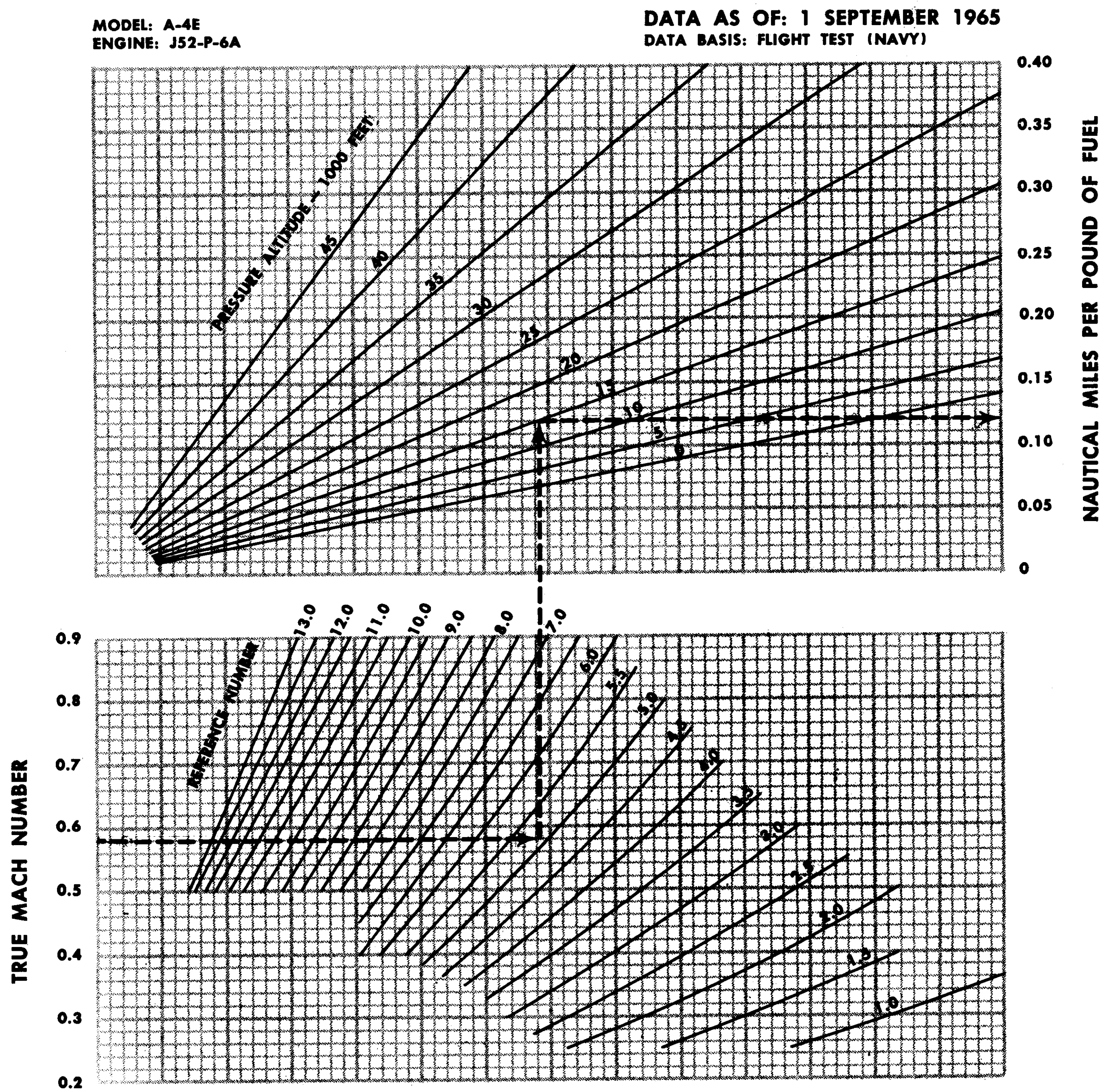
DATA AS OF: 1 SEPTEMBER 1965
DATA BASIS: FLIGHT TEST (NAVY)



P-40546-1

Figure 11-66. Nautical Miles per Pound of Fuel (Sheet 2)

NAUTICAL MILES PER POUND OF FUEL



P-40547-1

Figure 11-66. Nautical Miles per Pound of Fuel (Sheet 3)

NAUTICAL MILES PER POUND OF FUEL

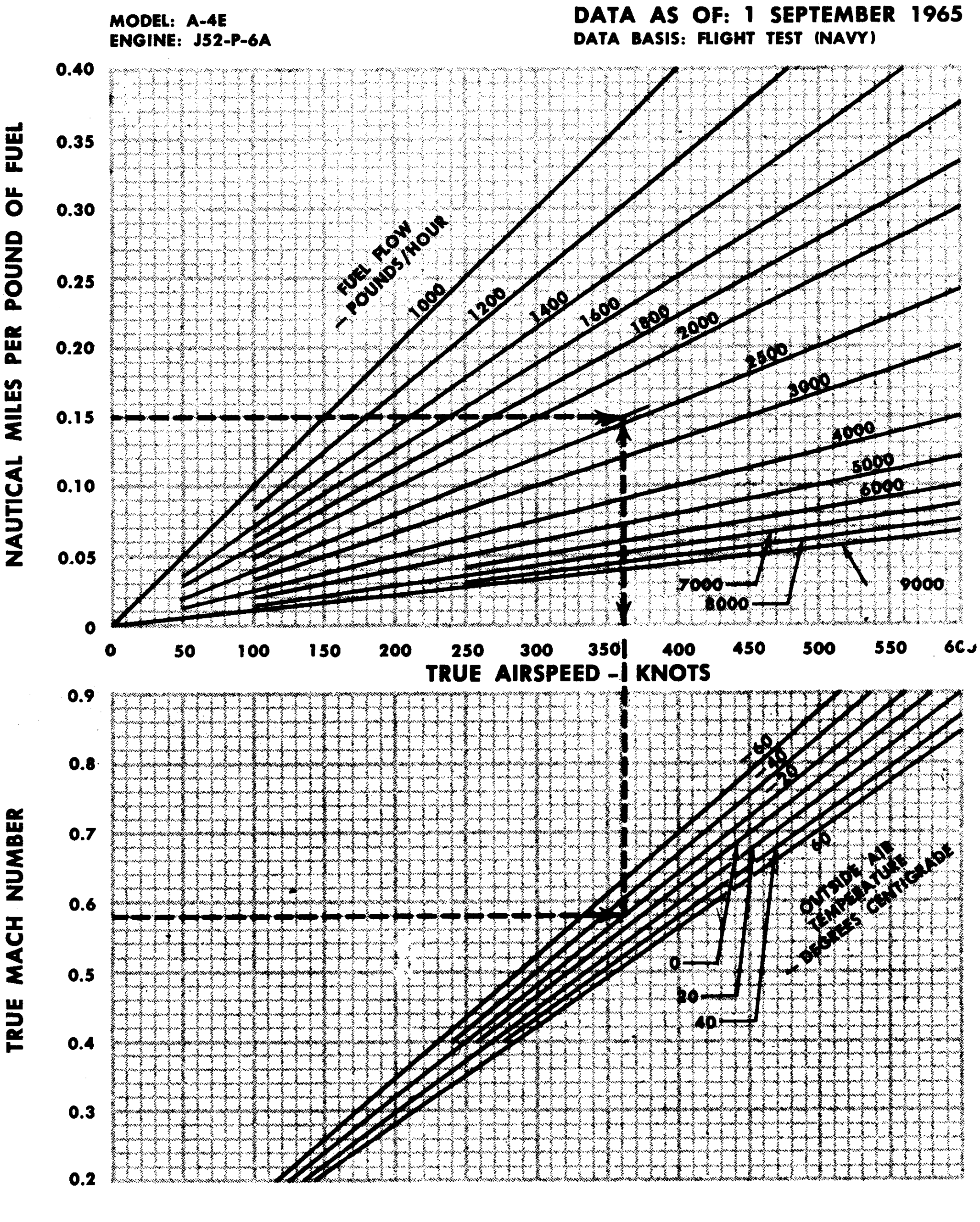


Figure 11-66. Nautical Miles per Pound of Fuel (Sheet 4)

ENGINE PRESSURE RATIO FOR CRUISE

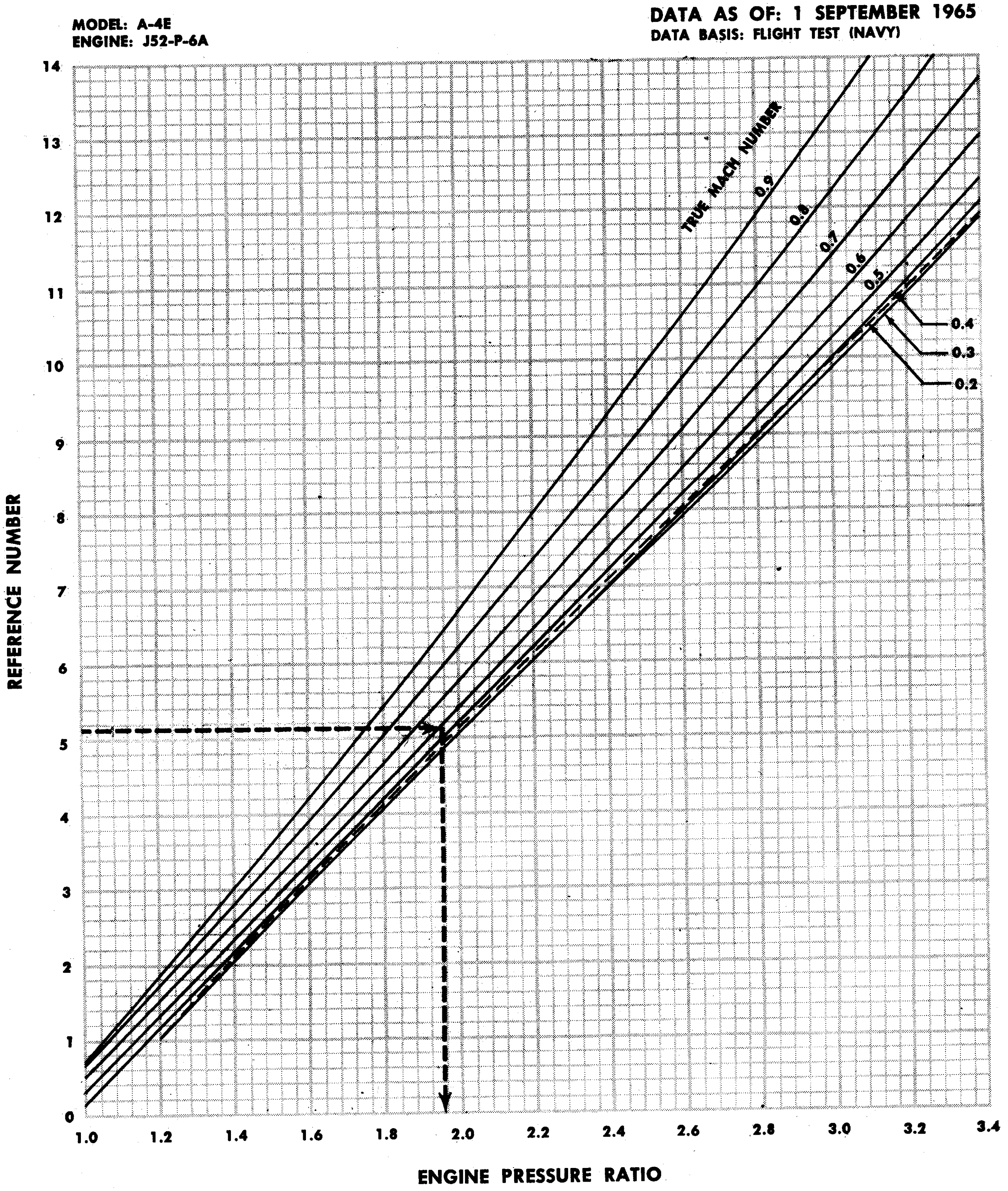


Figure 11-67. Engine Pressure Ratio for Cruise

PART 5A
ENDURANCE

FOULED DECK ENDURANCE CHART

Drag Index = 33
Aircraft Weight (Less Fuel) = 11,044 Pounds
Five Pylons and Guns
Includes 250 Pounds Reserve Fuel For Landing

Model: A-4E
Engine: J52-P-6A

Data as of: 1 September 1965
Data Basis: Flight Test (Navy)

Fuel On Board – Pounds	IF YOU ARE AT SEA LEVEL				IF YOU ARE AT 10,000 FEET				IF YOU ARE AT 20,000 FEET			
	Endurance At Sea Level	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 10,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 20,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude
	Minutes	Feet	Minutes	Knots	Minutes	Feet	Minutes	Knots	Minutes	Feet	Minutes	Knots
2300	69	35,000	97	190	84	35,000	102	190	97	35,000	106	190
1900	56	35,000	79	185	69	35,000	83	185	81	35,000	88	185
1700	49	35,000	69	185	61	35,000	74	185	72	35,000	78	185
1500	43	35,000	60	185	53	35,000	64	185	63	35,000	69	185
1300	36	35,000	50	180	46	35,000	55	185	55	35,000	59	185
1100	29	35,000	40	180	38	35,000	45	180	46	35,000	49	180
900	23	35,000	30	180	30	35,000	35	180	37	35,000	39	180
700	16	20,000	20	180	22	30,000	24	180	28	35,000	29	180
500	9	15,000	11	180	14	20,000	15	180	18	30,000	19	180

Fuel On Board – Pounds	IF YOU ARE AT 30,000 FEET				IF YOU ARE AT 35,000 FEET				IF YOU ARE AT 40,000 FEET			
	Endurance At 30,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 35,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 40,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude
	Minutes	Feet	Minutes	Knots	Minutes	Feet	Minutes	Knots	Minutes	Feet	Minutes	Knots
2300	108	35,000	109	190	111	35,000	111	190	109	35,000	112	190
1900	90	35,000	91	190	93	35,000	93	190	92	35,000	94	190
1700	81	35,000	82	185	83	35,000	83	190	82	35,000	85	190
1500	71	35,000	72	185	74	35,000	74	185	73	35,000	75	185
1300	62	35,000	63	185	64	35,000	64	185	64	35,000	65	185
1100	52	35,000	53	185	54	35,000	54	185	55	40,000	55	180
900	42	35,000	43	180	44	35,000	44	180	45	40,000	45	180
700	32	35,000	32	180	34	35,000	34	180	35	40,000	35	180
500	22	30,000	22	180	24	35,000	24	180	25	40,000	25	180

Pressure Altitude	Climb Speed Military Thrust		Descent Speed Engine Idle – Speedbrakes Closed	Start Letdown From Altitude With Fuel Remaining
Feet	KCAS	Mach No.	KCAS	Pounds
Sea Level	335		180	250
10,000	340		180	315
20,000	320		180	350
30,000		0.77	180	375
35,000		0.77	180	390
40,000		0.77	180	400

Figure 11-68. Fouled Deck Endurance

BINGO ENDURANCE

Aircraft Weight (Less Fuel) = 11,458 Pounds
Five Pylons, Guns, and 2 300-Gallon External Tanks
Drag Index = 60
Includes 800 Pounds Reserve Fuel For Landing

Model: A-4E
Engine: J52-P-6A

Data as of: 1 September 1965
Data Basis: Flight Test (Navy)

FUEL ON BOARD – POUNDS	IF YOU ARE AT SEA LEVEL				IF YOU ARE AT 10,000 FEET				IF YOU ARE AT 20,000 FEET			
	Endurance At Sea Level	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 10,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 20,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude
	Minutes	Feet	Minutes	Knots	Minutes	Feet	Minutes	Knots	Minutes	Feet	Minutes	Knots
2700	59	30,000	79	190	72	30,000	83	190	83	35,000	87	190
2500	53	30,000	71	190	65	30,000	75	190	76	35,000	79	190
2300	47	30,000	63	190	58	30,000	67	190	68	35,000	71	190
2100	41	30,000	54	190	51	30,000	59	190	60	35,000	62	190
1900	35	30,000	46	190	44	30,000	50	190	52	35,000	54	190
1700	29	30,000	37	185	37	30,000	41	185	44	35,000	45	185
1500	22	30,000	29	185	24	30,000	33	185	36	30,000	37	185
1300	16	20,000	20	185	17	20,000	24	185	28	20,000	28	185
1100	10	15,000	12	185	15	20,000	16	185	19	20,000	19	185

FUEL ON BOARD – POUNDS	IF YOU ARE AT 30,000 FEET				IF YOU ARE AT 35,000 FEET				IF YOU ARE AT 40,000 FEET			
	Endurance At 30,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 35,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 40,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude
	Minutes	Feet	Minutes	Knots	Minutes	Feet	Minutes	Knots	Minutes	Feet	Minutes	Knots
2700	91	30,000	91	190	92	35,000	92	190	89	35,000	94	190
2500	82	30,000	82	190	84	35,000	84	190	82	35,000	86	190
2300	77	30,000	77	190	76	35,000	76	190	74	35,000	77	190
2100	66	30,000	66	190	68	35,000	68	190	67	35,000	69	190
1900	58	30,000	58	190	59	35,000	59	190	59	35,000	60	190
1700	49	30,000	49	190	51	35,000	51	190	51	35,000	52	190
1500	40	30,000	40	190	42	35,000	42	190	42	35,000	43	190
1300	32	30,000	32	185	33	35,000	33	185	34	40,000	34	185
1100	22	30,000	22	185	24	35,000	24	185	25	40,000	25	185

Pressure Altitude	Climb Speed Military Thrust		Descent Speed Engine Idle – Speedbrakes Closed	Start Letdown From Altitude With Fuel Remaining
Feet	KCAS	Mach No.	KCAS	Pounds
Sea Level	340		180	800
10,000	320		180	860
20,000	300		180	890
30,000		0.75	180	915
35,000		0.75	180	925
40,000		0.75	180	935

Figure 11-69. Bingo Endurance

MAXIMUM ENDURANCE SPEED

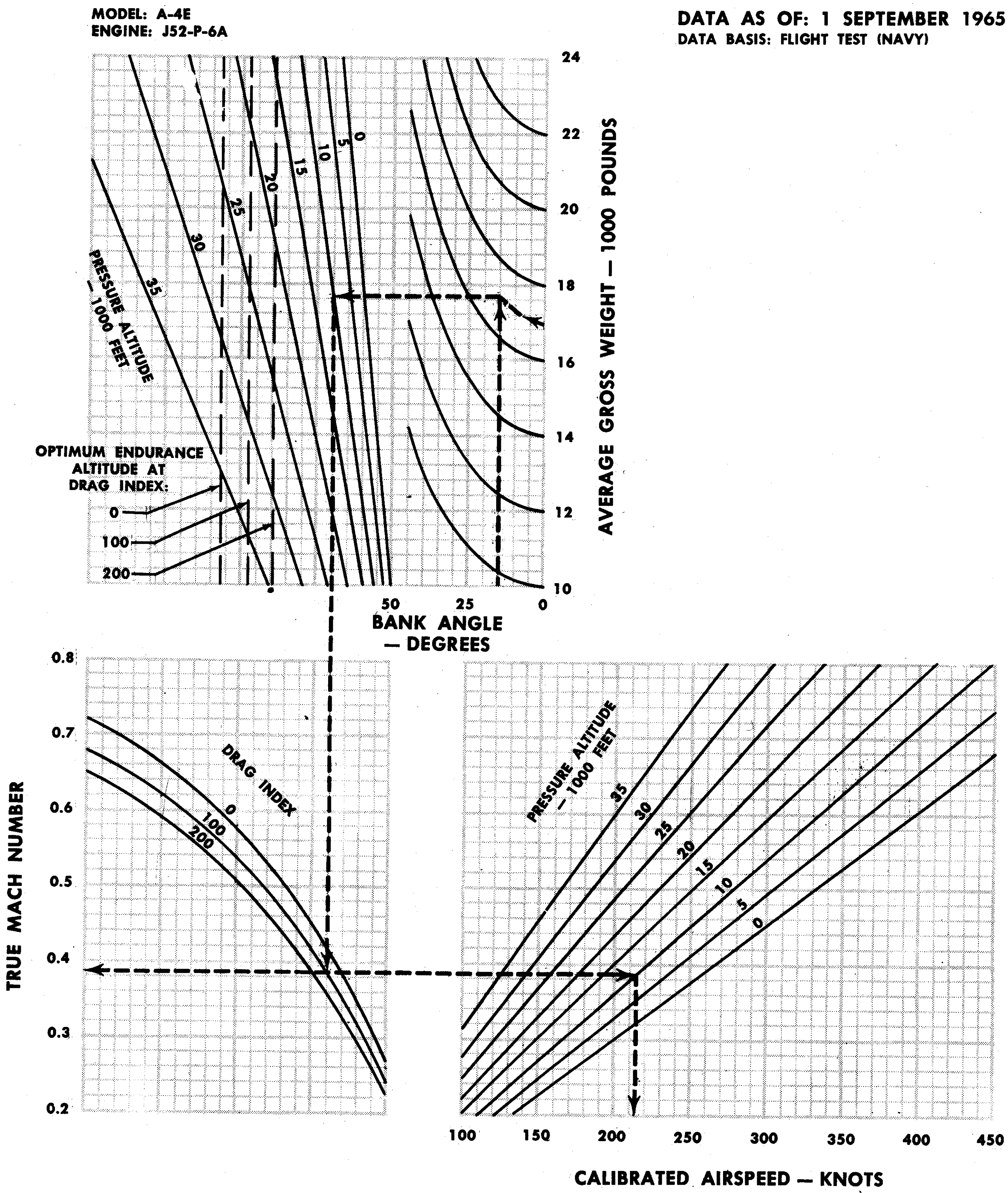


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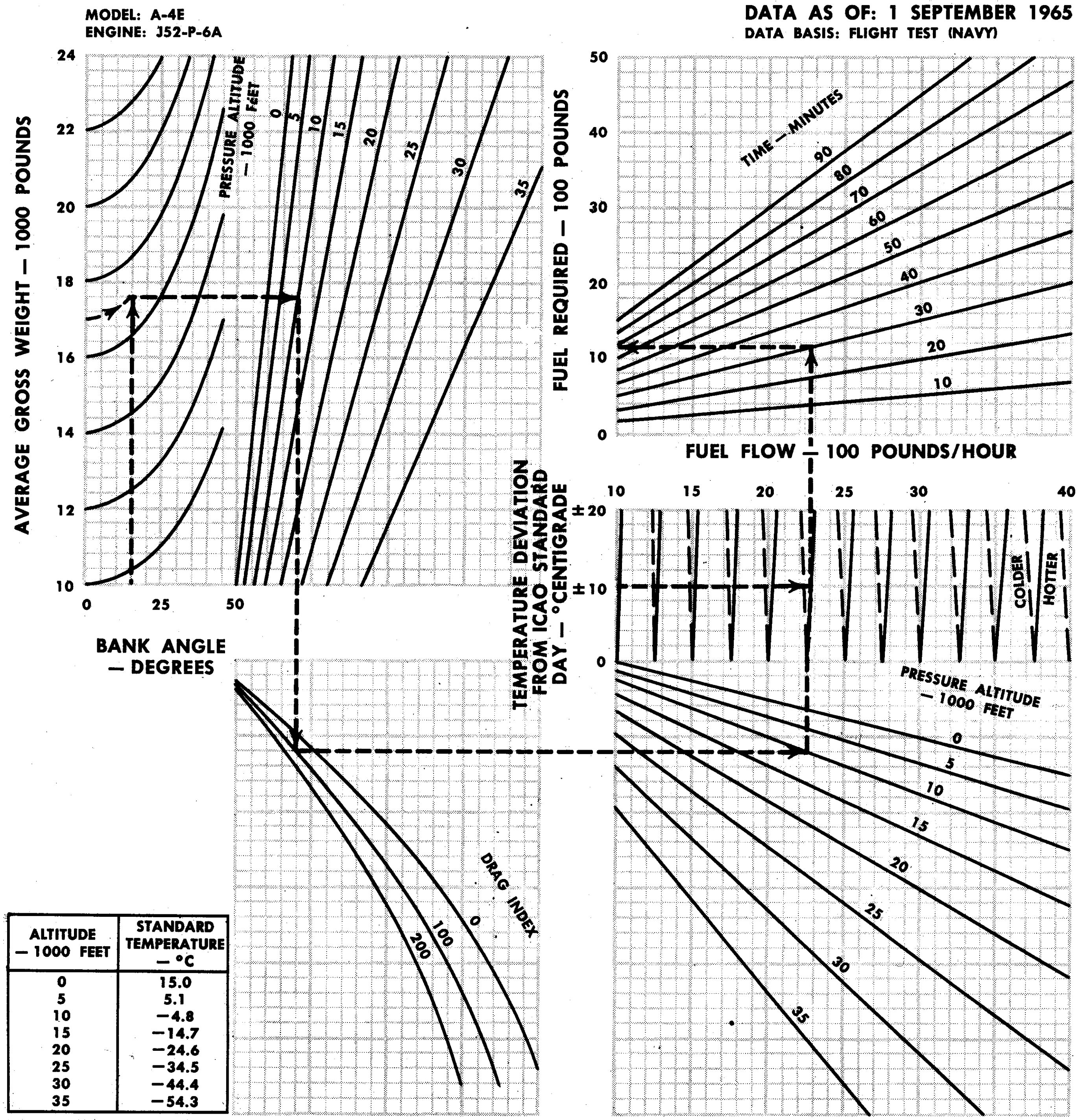
Figure 11-70. Maximum Endurance Speed

MAXIMUM ENDURANCE FUEL



ALTITUDE — 1000 FEET	STANDARD TEMPERATURE — °C
0	15.0
5	5.1
10	−4.8
15	−14.7
20	−24.6
25	−34.5
30	−44.4
35	−54.3

Figure 11-71. Maximum Endurance Fuel

PART 6A
AIR REFUELING

TANKER SPEED ENVELOPE

TANKER CONFIGURATION

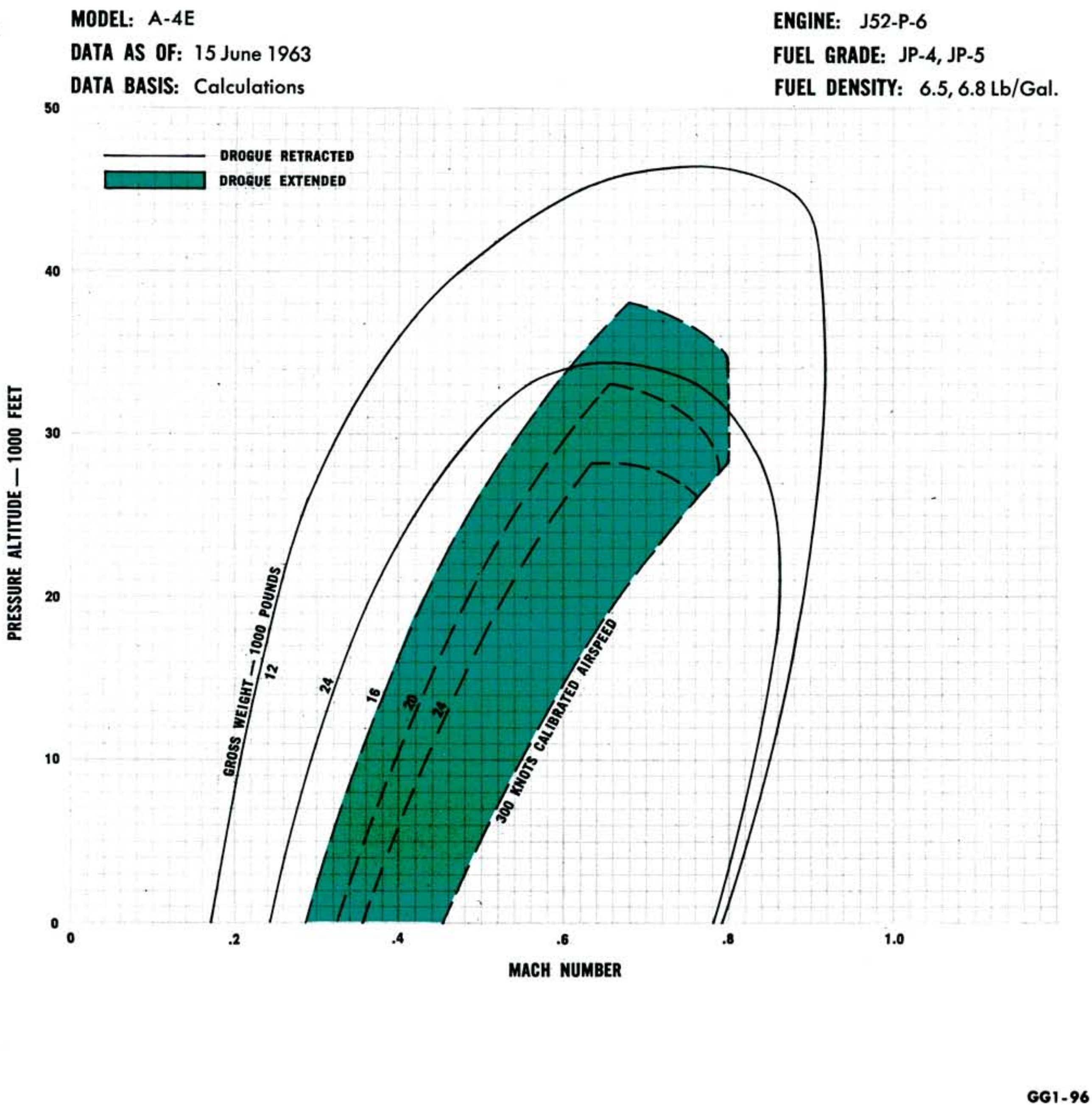


Figure 11-72. Tanker Speed Envelope

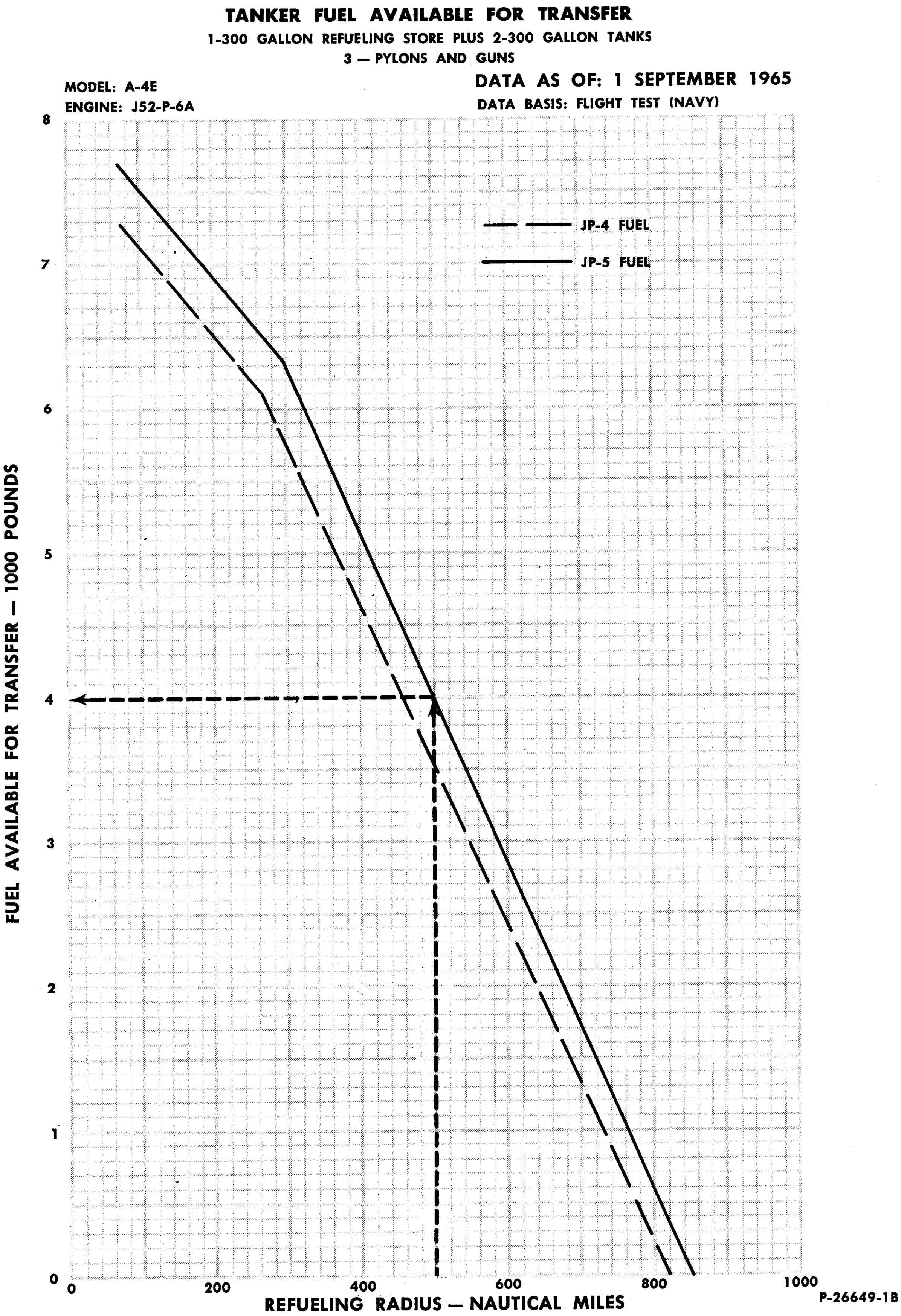


Figure 11-73. Tanker Fuel Available for Transfer

TANKER FUEL TRANSFER TIME
1—300 GALLON REFUELING STORE PLUS 2—300 GALLON TANKS
3—PYLONS AND GUNS

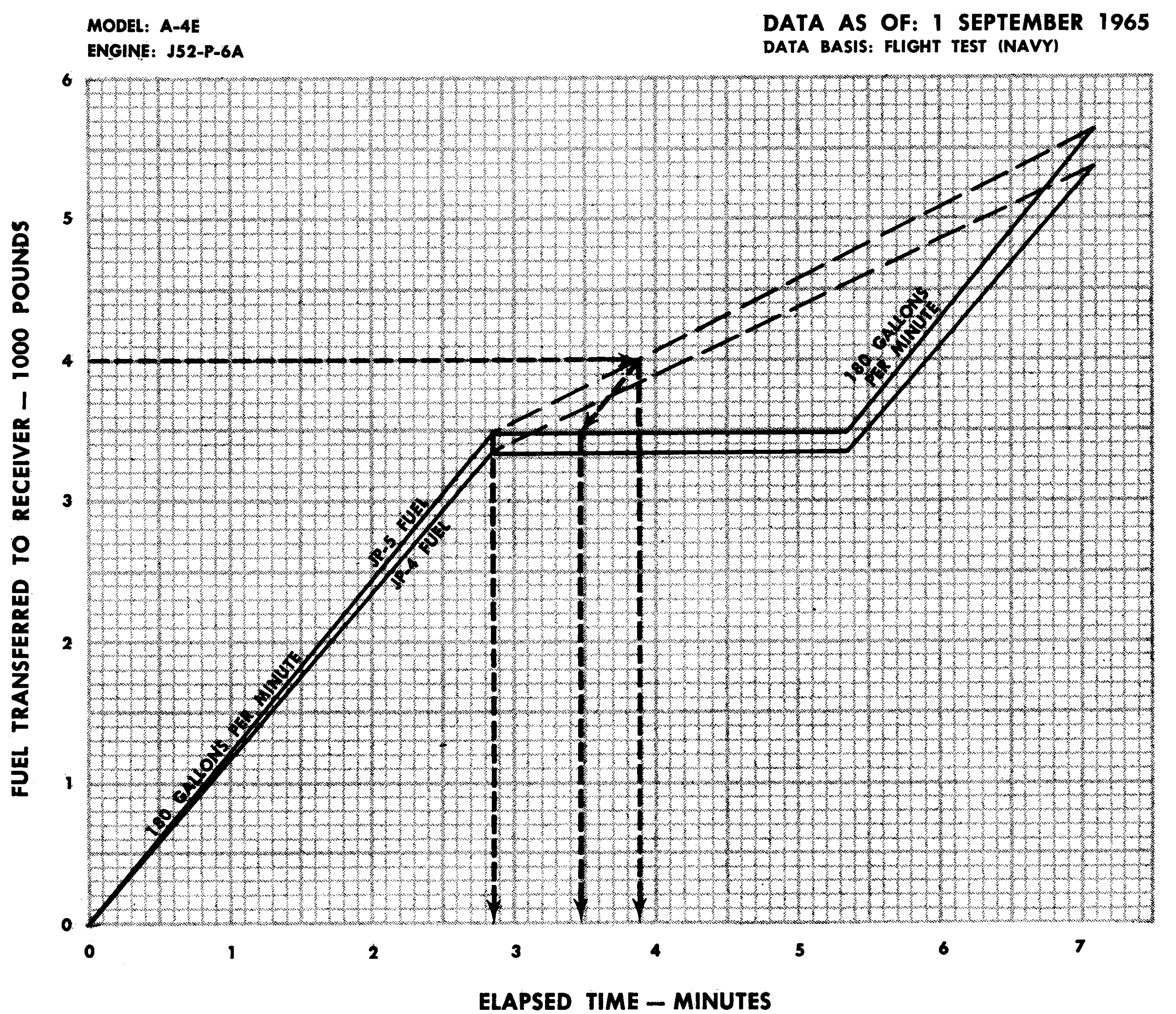


Figure 11-74. Tanker Fuel Transfer Time

FUEL CONSUMPTION OF TANKER DURING AIR REFUELING

MODEL: A-4E
DATA AS OF: 15 June 1963
DATA BASIS: Calculations

ENGINE: J52-P-6
FUEL GRADE: JP-4, JP-5
FUEL DENSITY: 6.5, 6.8 Lb/Gal.

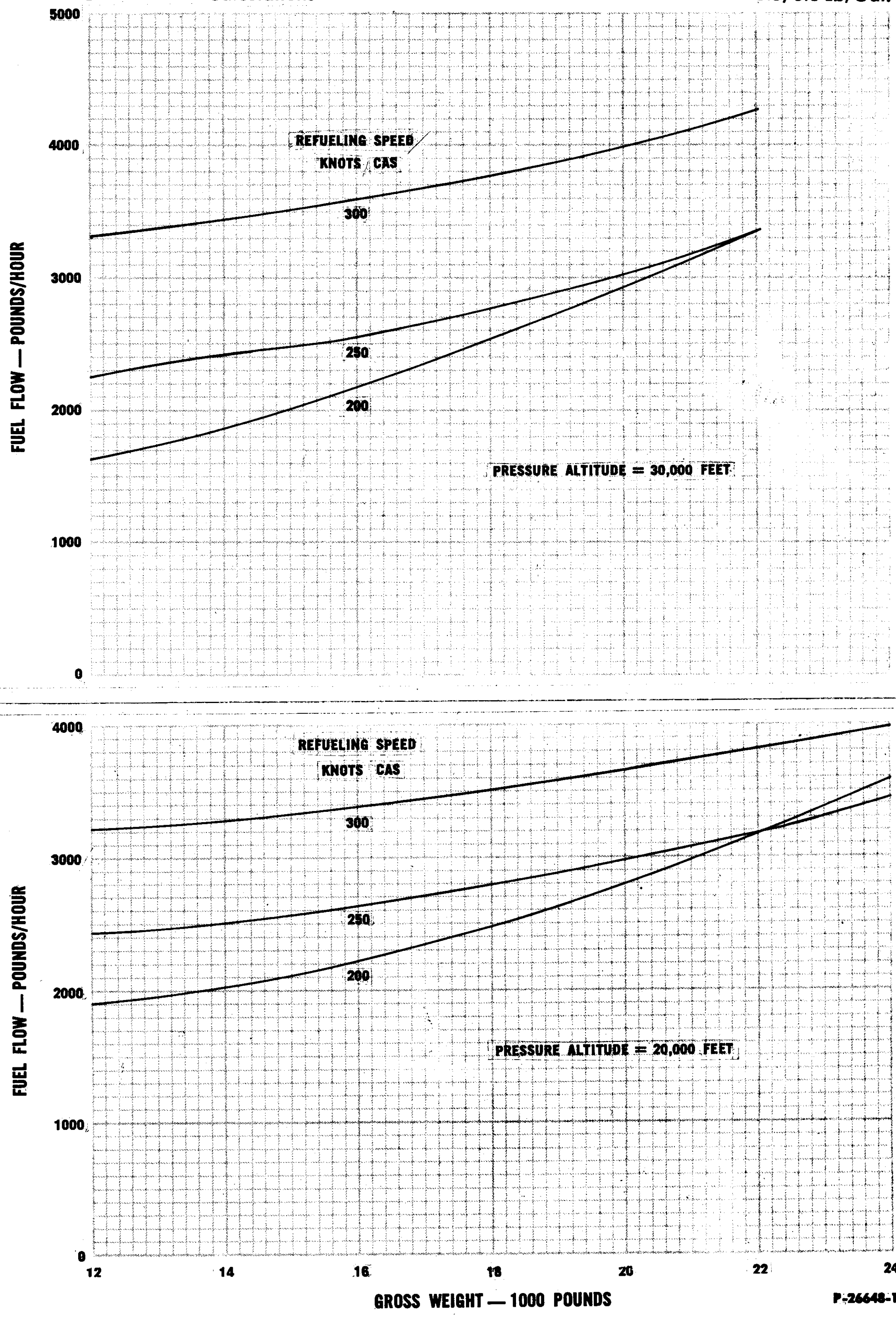


Figure 11-75. Fuel Consumption of Tanker During Air Refueling

PART 7A
DESCENT

DESCENT FUEL

IDLE THRUST

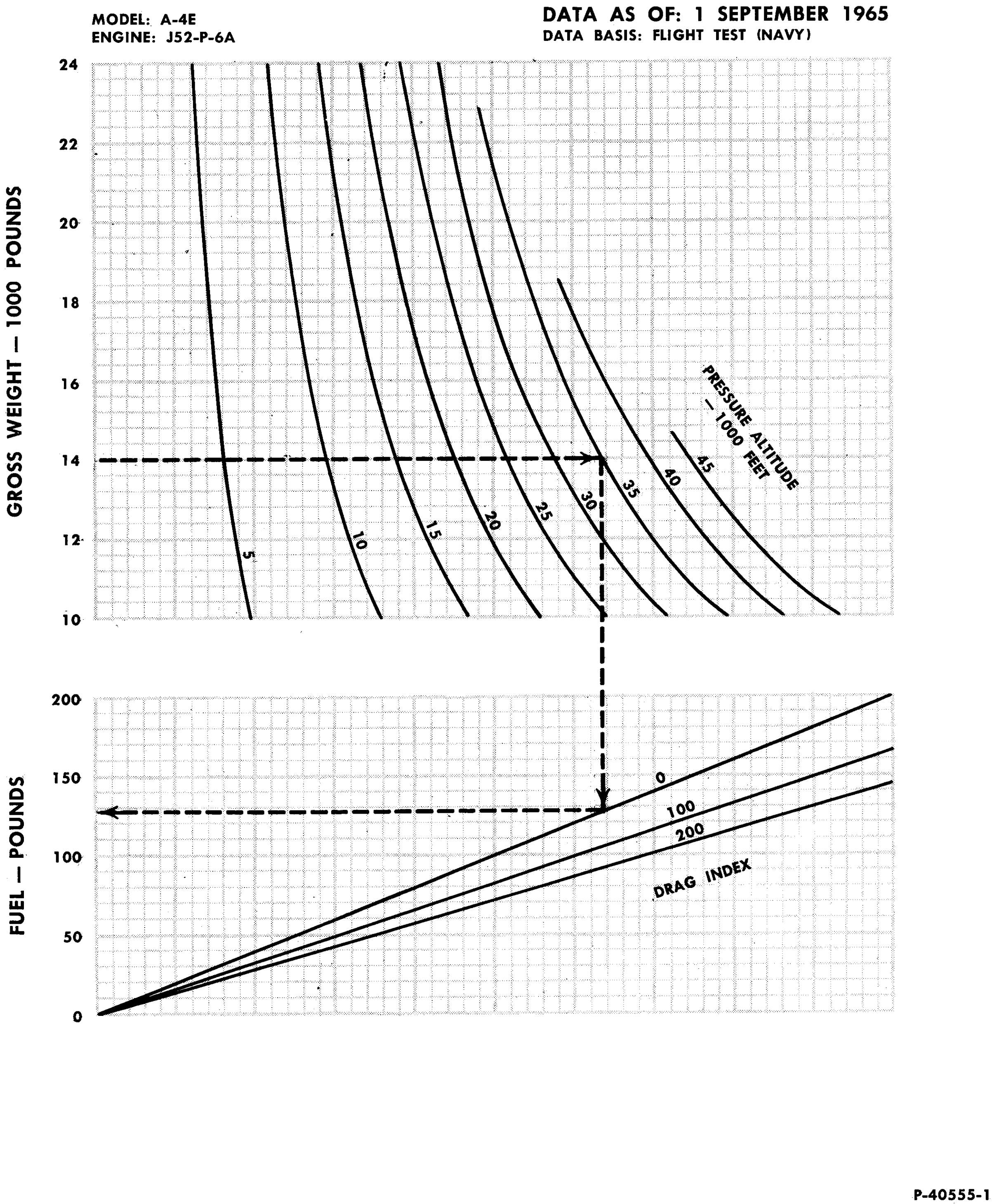
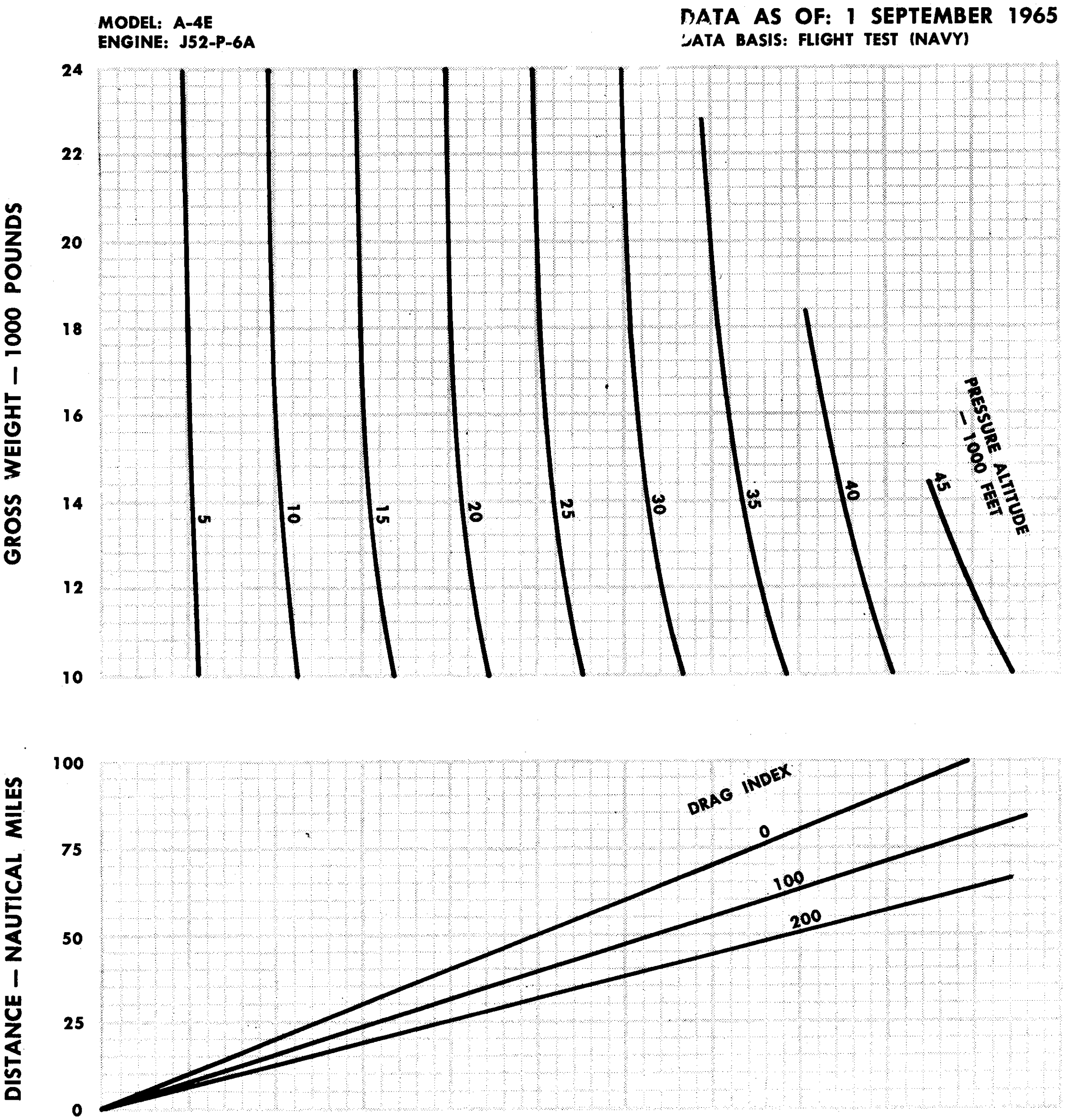


Figure 11-76. Descent Fuel

DESCENT DISTANCE
IDLE THRUST



DESCENT SPEED SCHEDULE — KCAS

	GROSS WEIGHT — 1000 POUNDS							
DRAG INDEX	10	12	14	16	18	20	22	24
0	175	190	205	220	235	250	260	270
100	160	175	190	205	215	225	235	245
200	150	165	180	190	200	210	220	230

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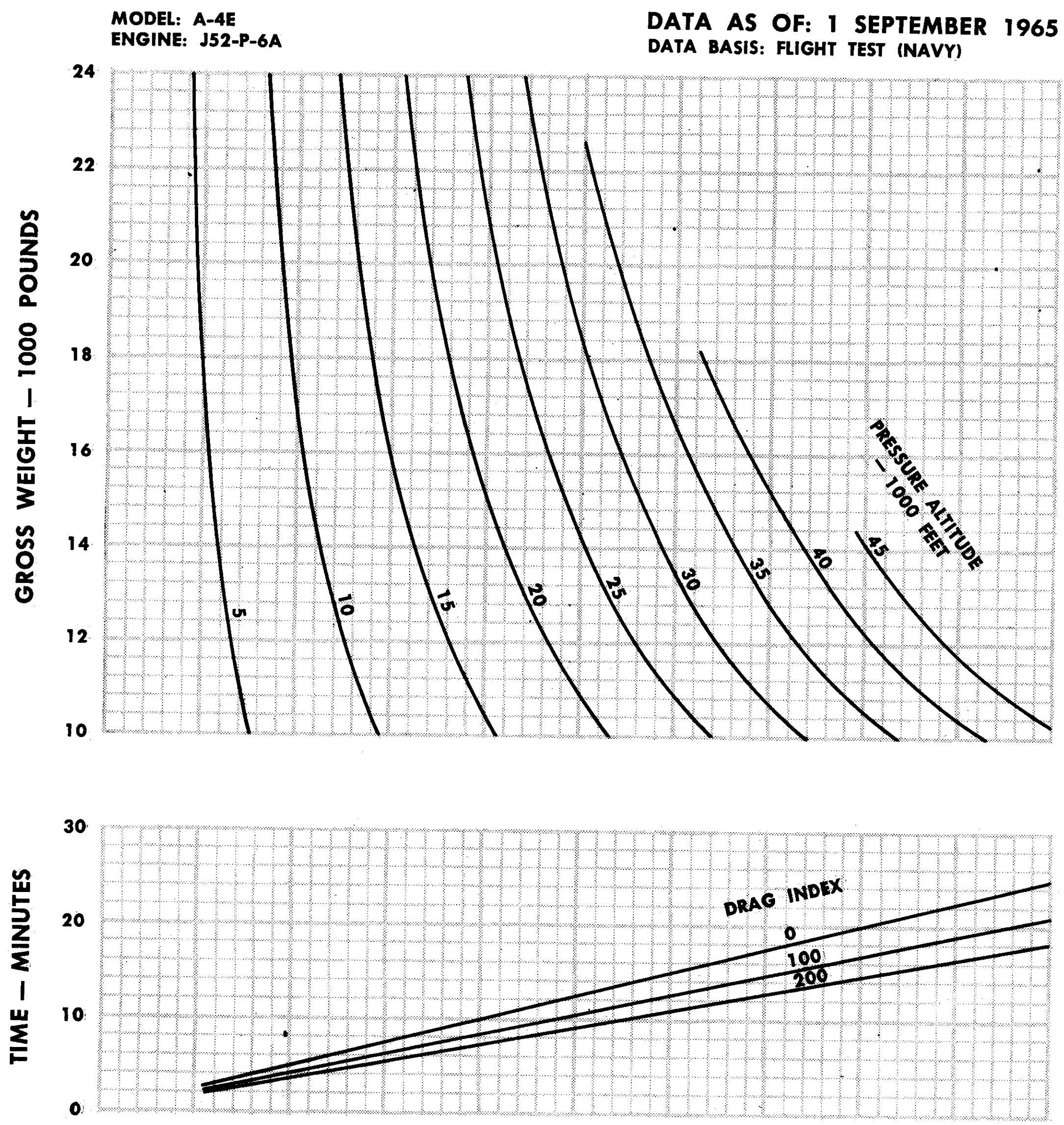
Figure 11-77. Descent Distance

DESCENT TIME
IDLE THRUST



P-40557-1

Figure 11-78. Descent Time

PART 8A
LANDING

APPROACH SPEED

GEAR DOWN — SPEEDBRAKES OPEN
THRUST REQUIRED TO MAINTAIN 4° GLIDE SLOPE

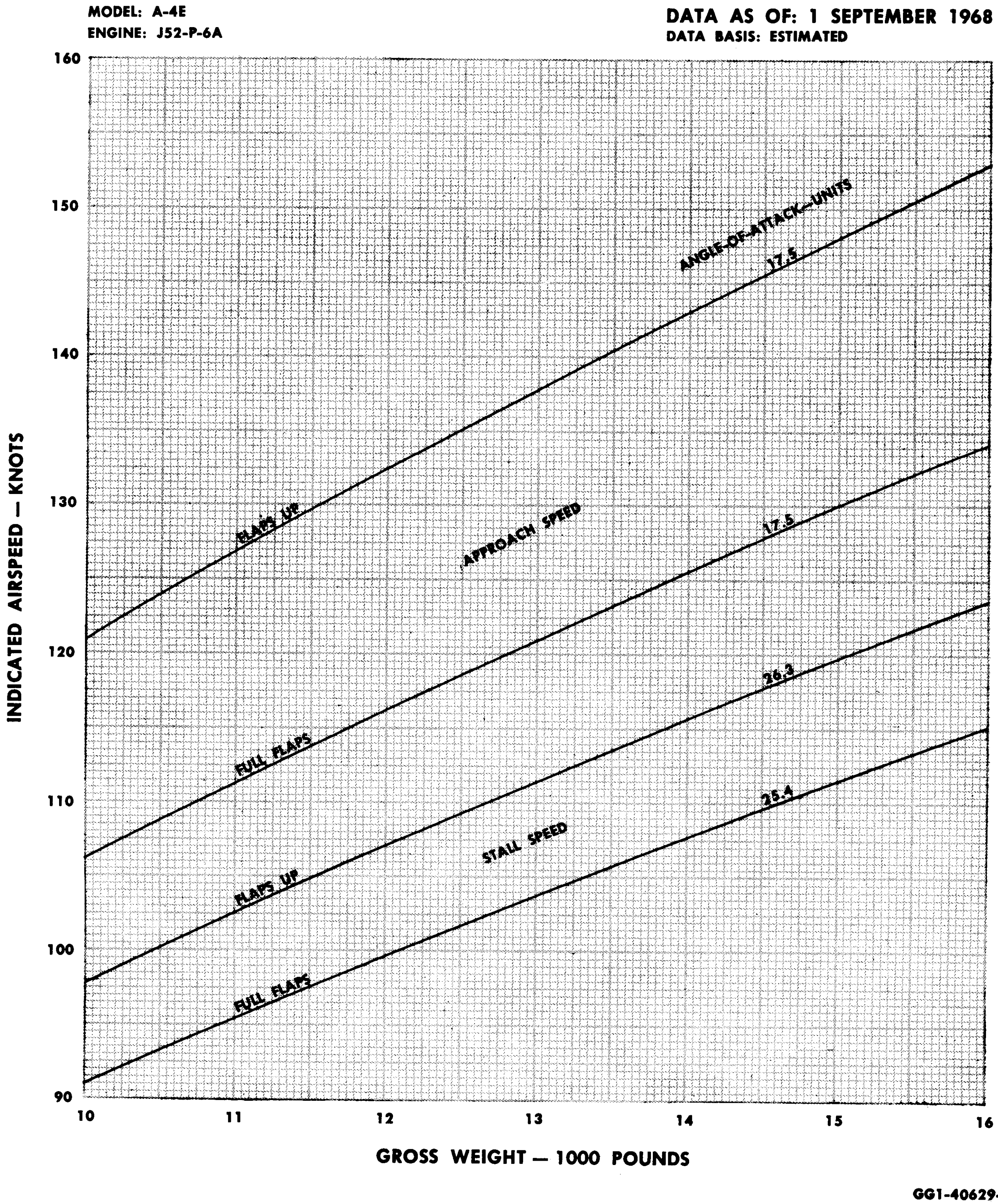


Figure 11-79. Approach Speed

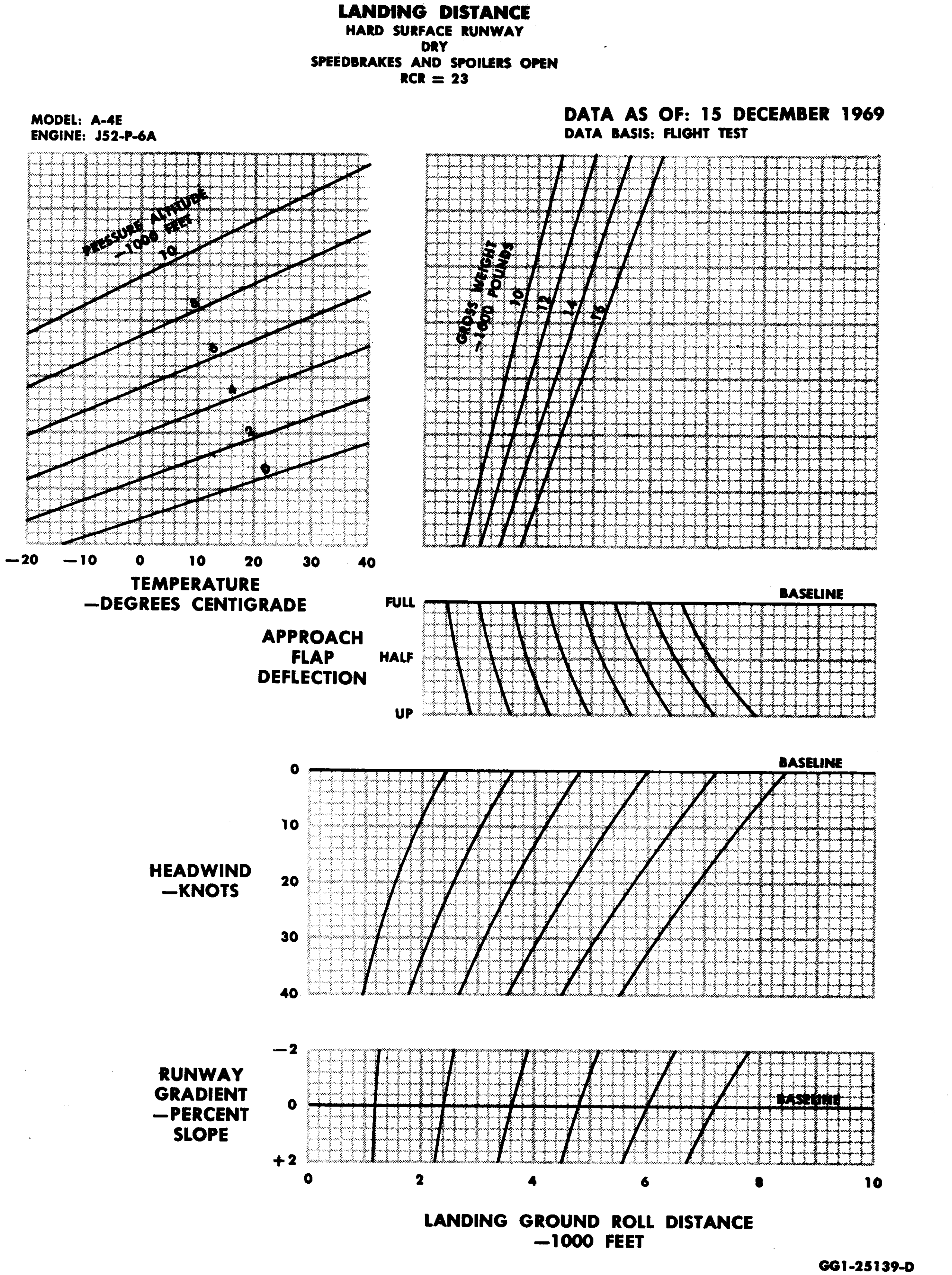


Figure 11-80. Landing Distance (Sheet 1)

LANDING DISTANCE
HARD SURFACE RUNWAY
WET
SPEEDBRAKES AND SPOILERS OPEN
RCR = 15

MODEL: A-4E
ENGINE: J52-P-6A

DATA AS OF: 15 DECEMBER 1969
DATA BASIS: FLIGHT TEST

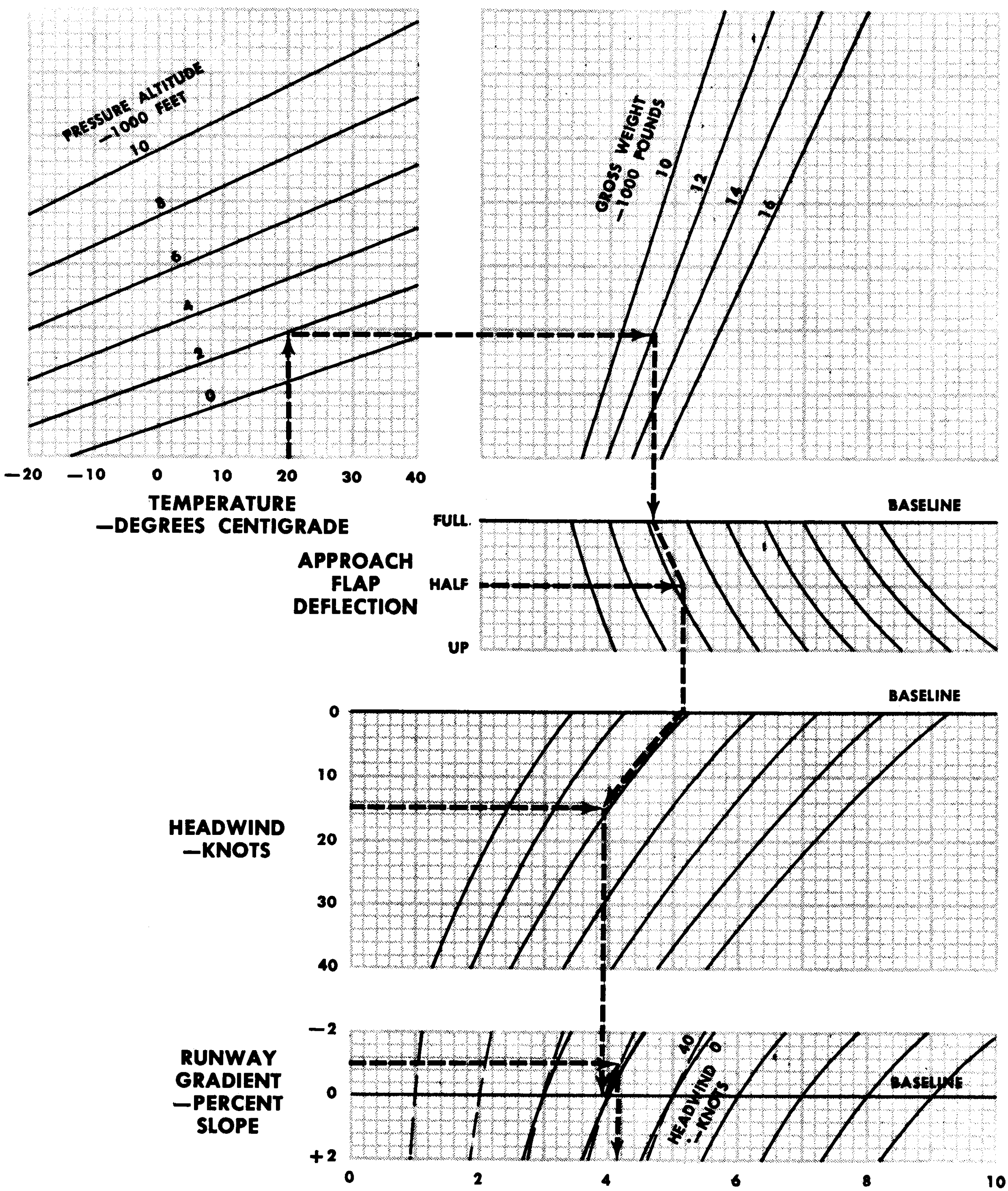


Figure 11-80. Landing Distance (Sheet 2)

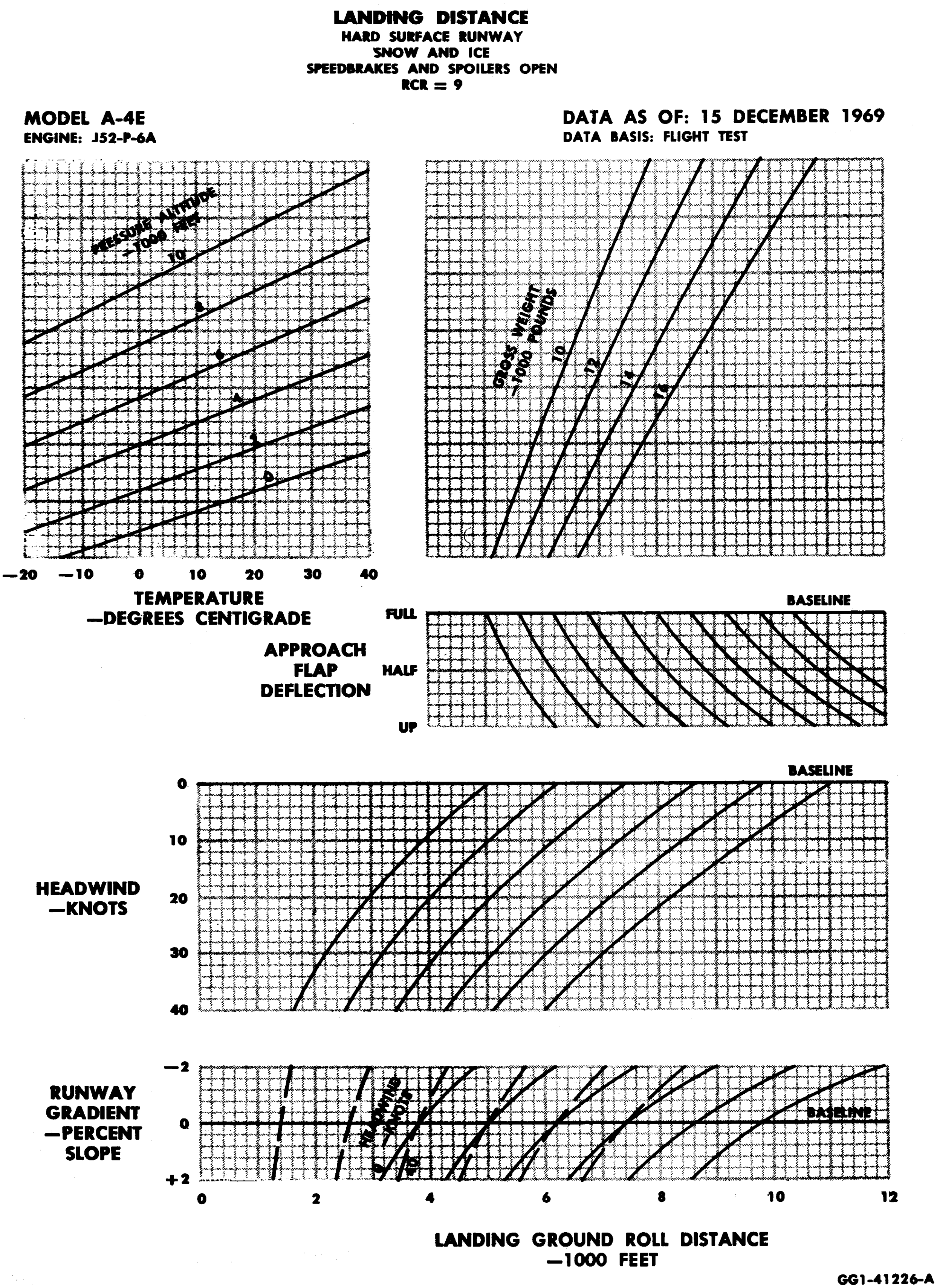


Figure 11-80. Landing Distance (Sheet 3)

LANDING DISTANCE
HARD SURFACE RUNWAY
DRY
SPEEDBRAKES OPEN
NO SPOILERS
RCR = 23

MODEL A-4E
ENGINE: J52-P-6A

DATA AS OF: OCTOBER 1968
DATA BASIS: FLIGHT TEST (NAVY)

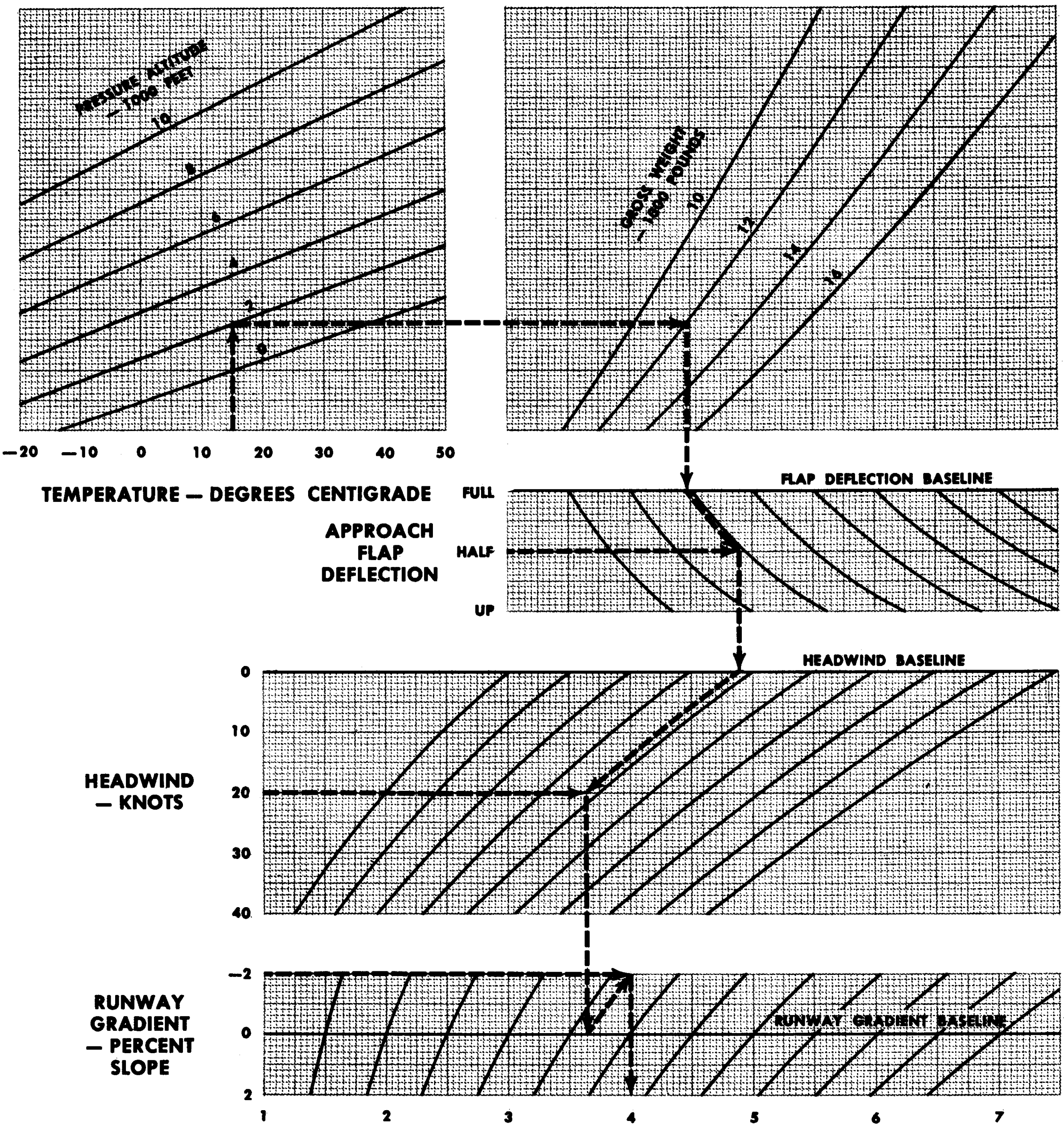


Figure 11-80. Landing Distance (Sheet 4)

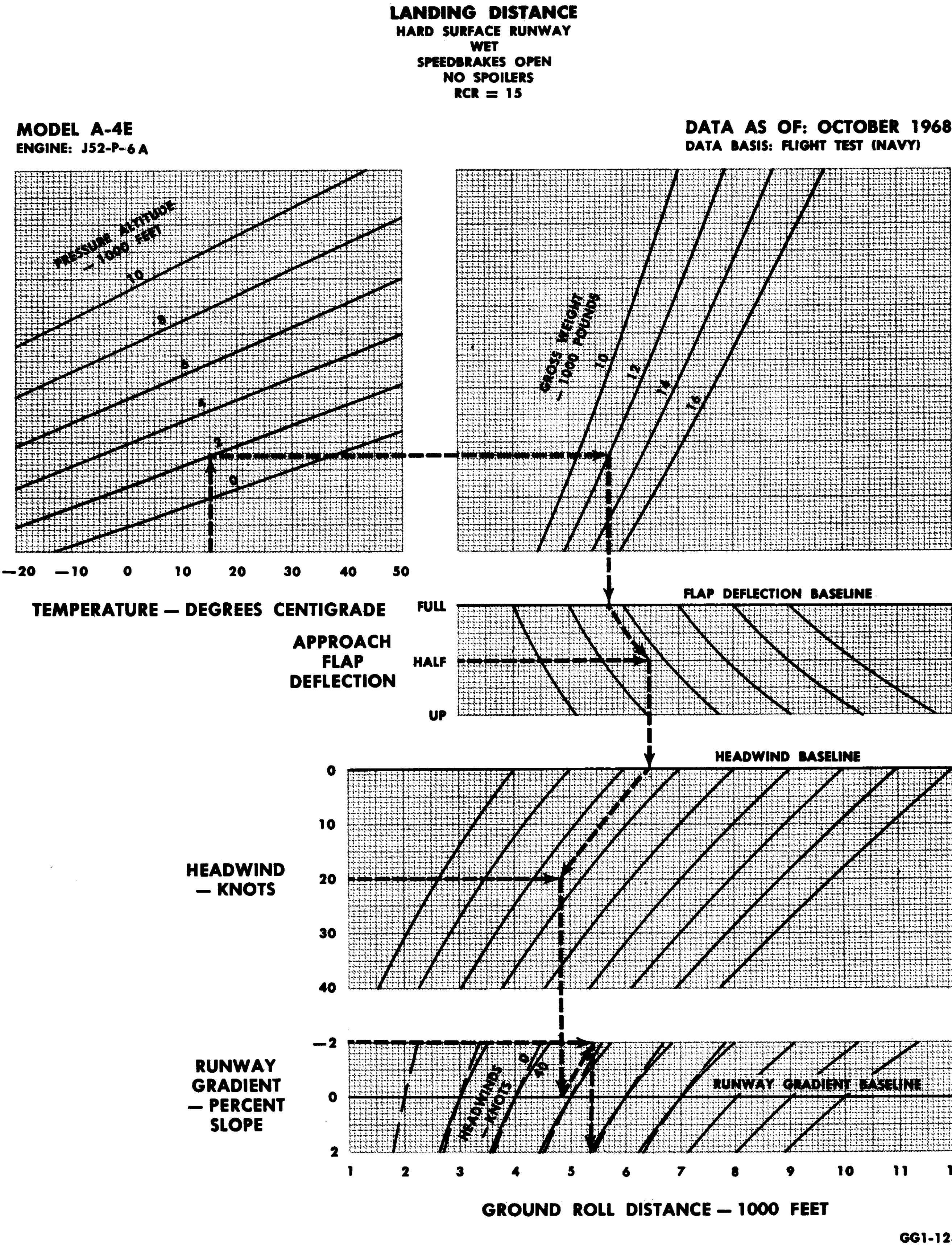


Figure 11-80. Landing Distance (Sheet 5)

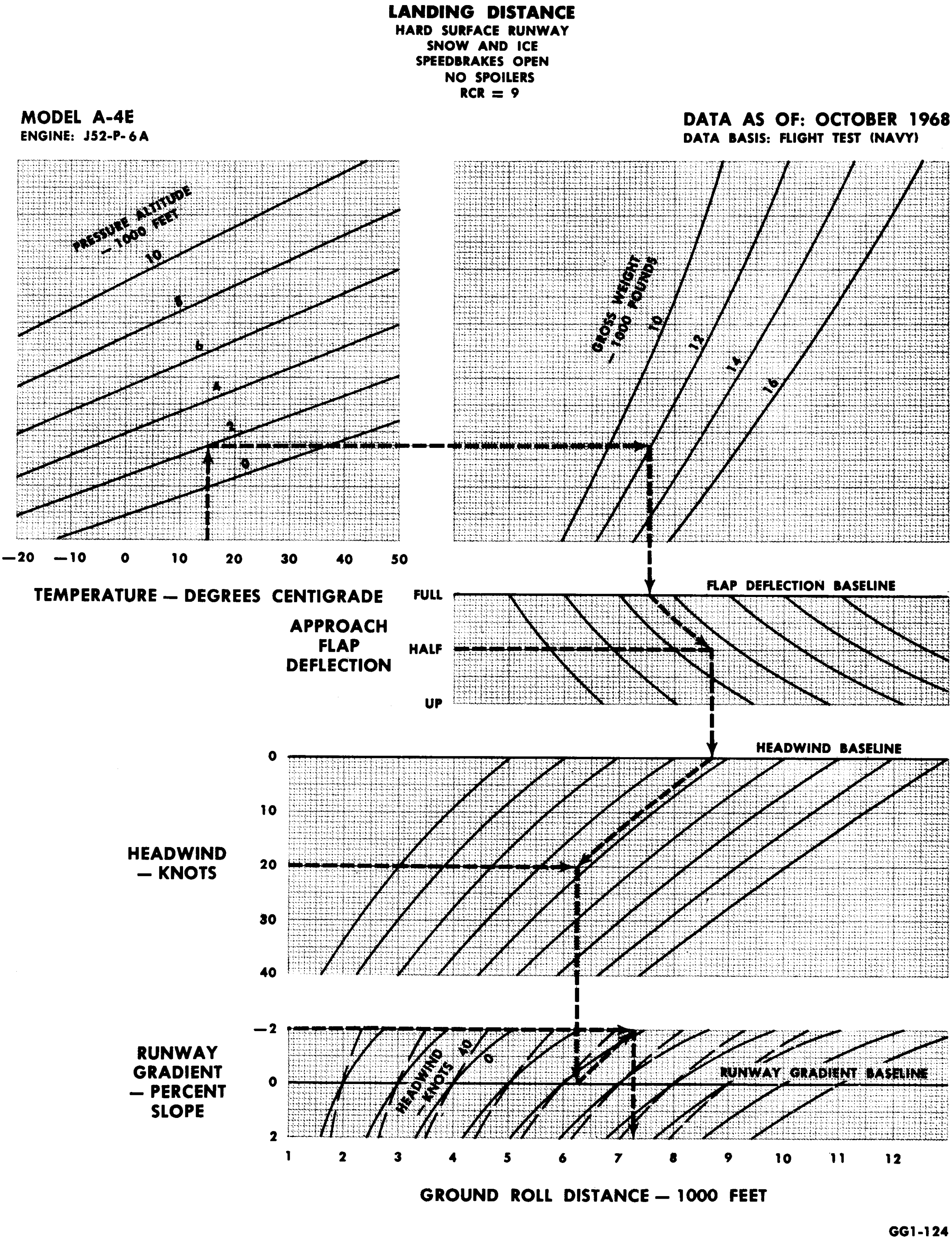


Figure 11-80. Landing Distance (Sheet 6)

PART 9A
COMBAT PERFORMANCE

TURNING RADIUS

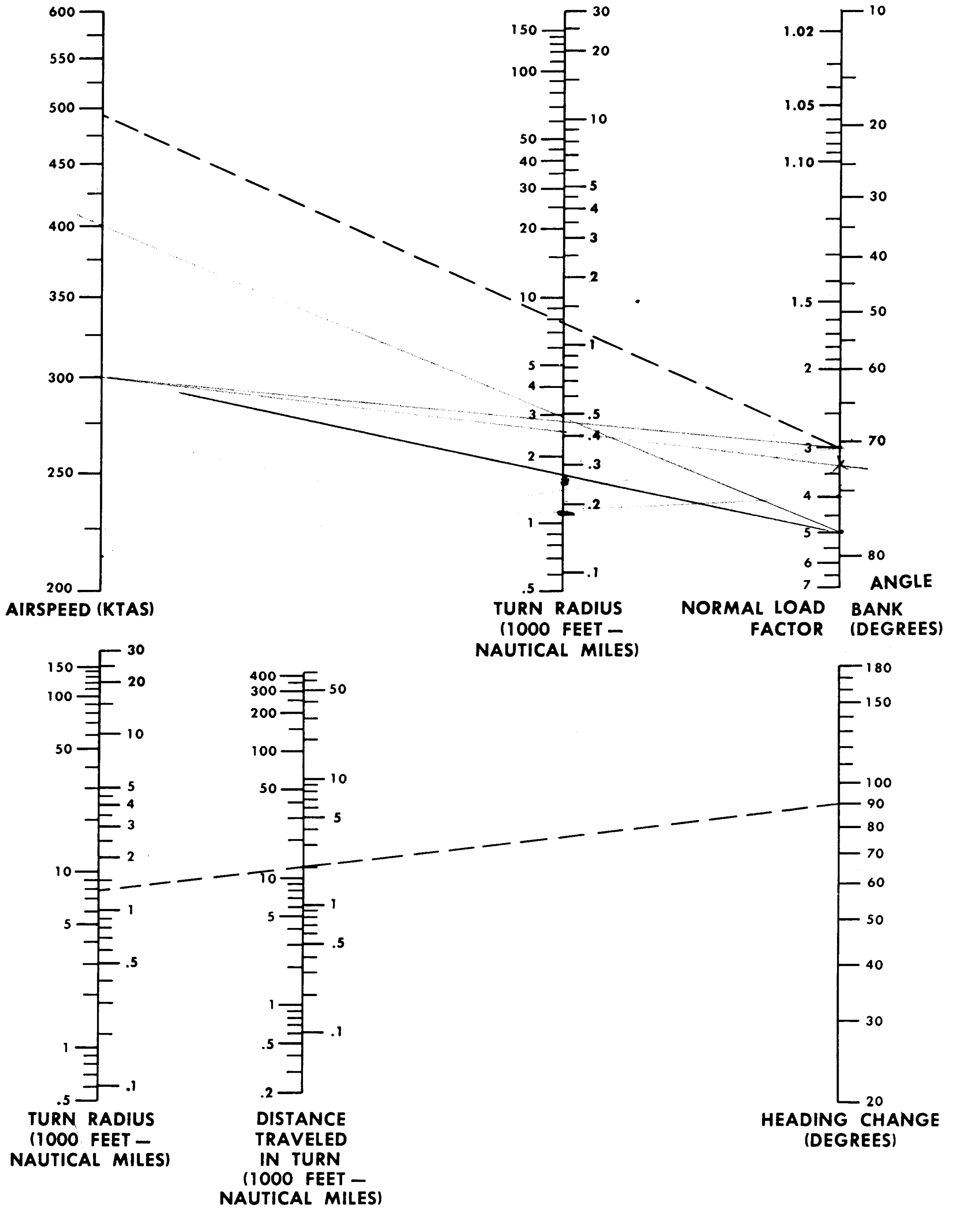


Figure 11-81. Turning Radius

PART 9A
COMBAT PERFORMANCE

TURNING RADIUS

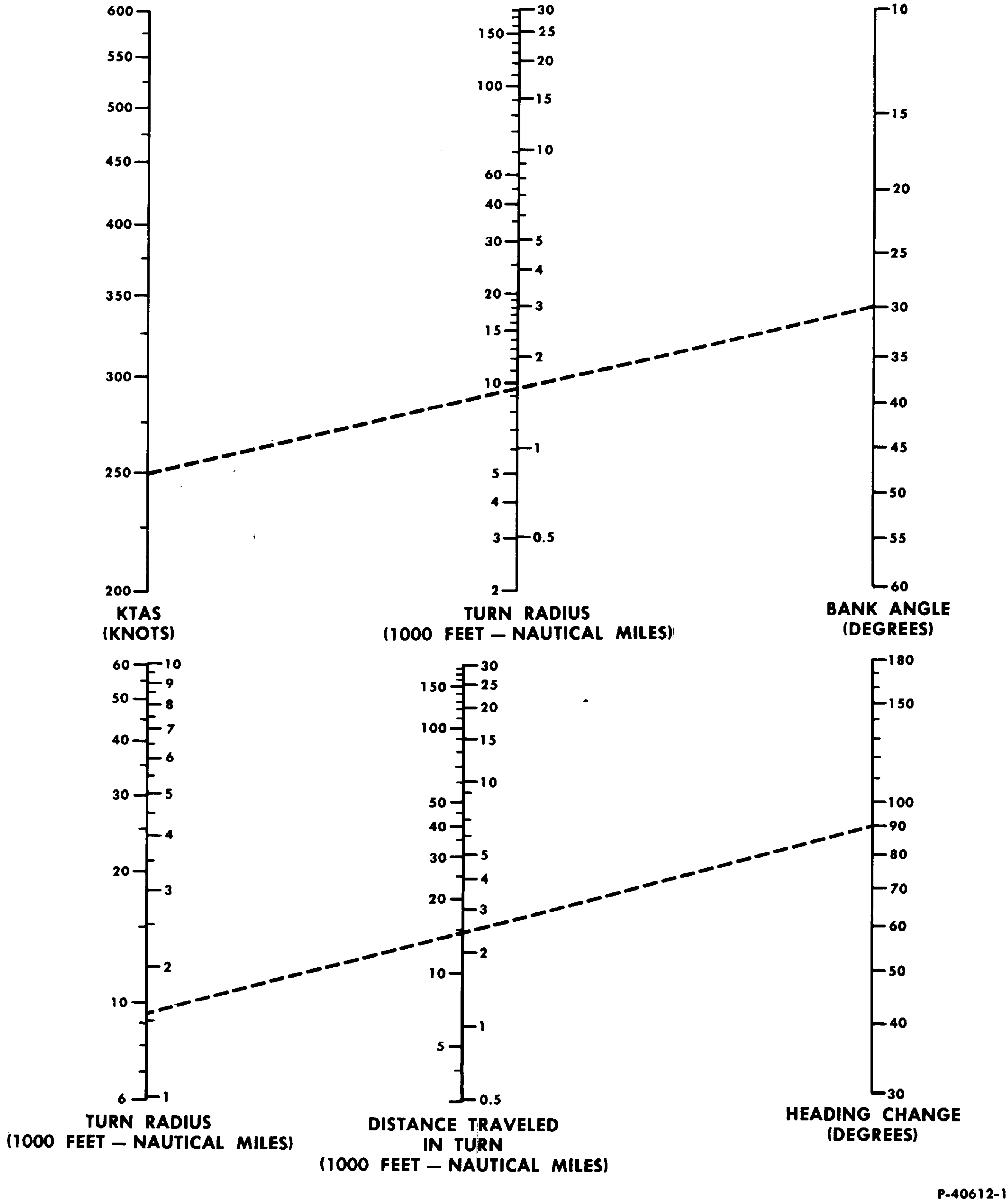


Figure 11-81. Turning Radius

MANEUVERABILITY

MILITARY THRUST

SEA LEVEL STANDARD DAY

FLAPS UP

GEAR UP

MODEL: A-4E

ENGINE: J52-P-6A

DATA AS OF: 1 SEPTEMBER 1968

DATA BASIS: ESTIMATED

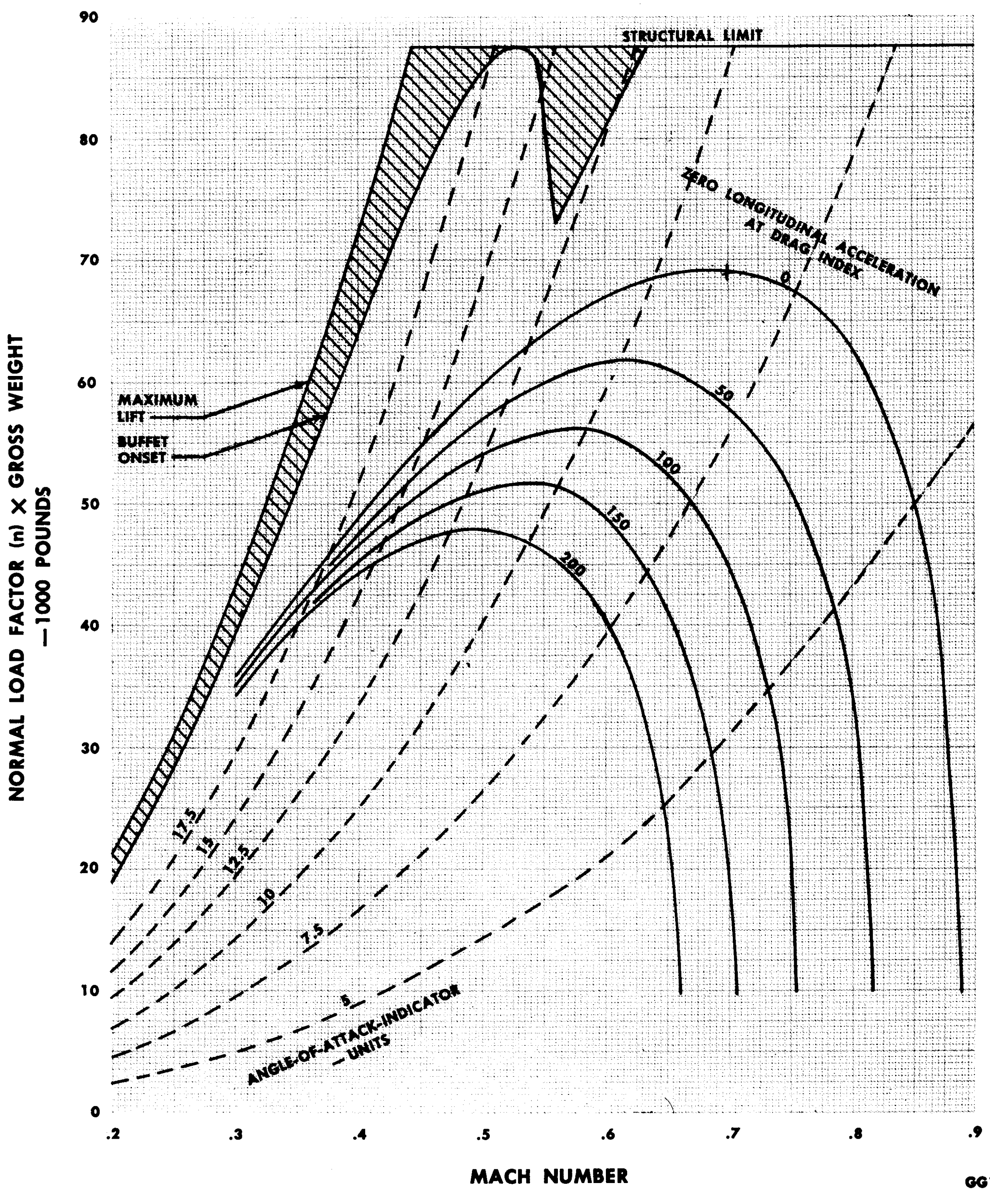


Figure 11-82. Maneuverability (Sheet 1)

MANEUVERABILITY

MILITARY THRUST
10,000 FEET STANDARD DAY

FLAPS UP

GEAR UP

MODEL: A-4E
ENGINE: J52-P-6A

DATA AS OF: 1 SEPTEMBER 1968
DATA BASIS: ESTIMATED

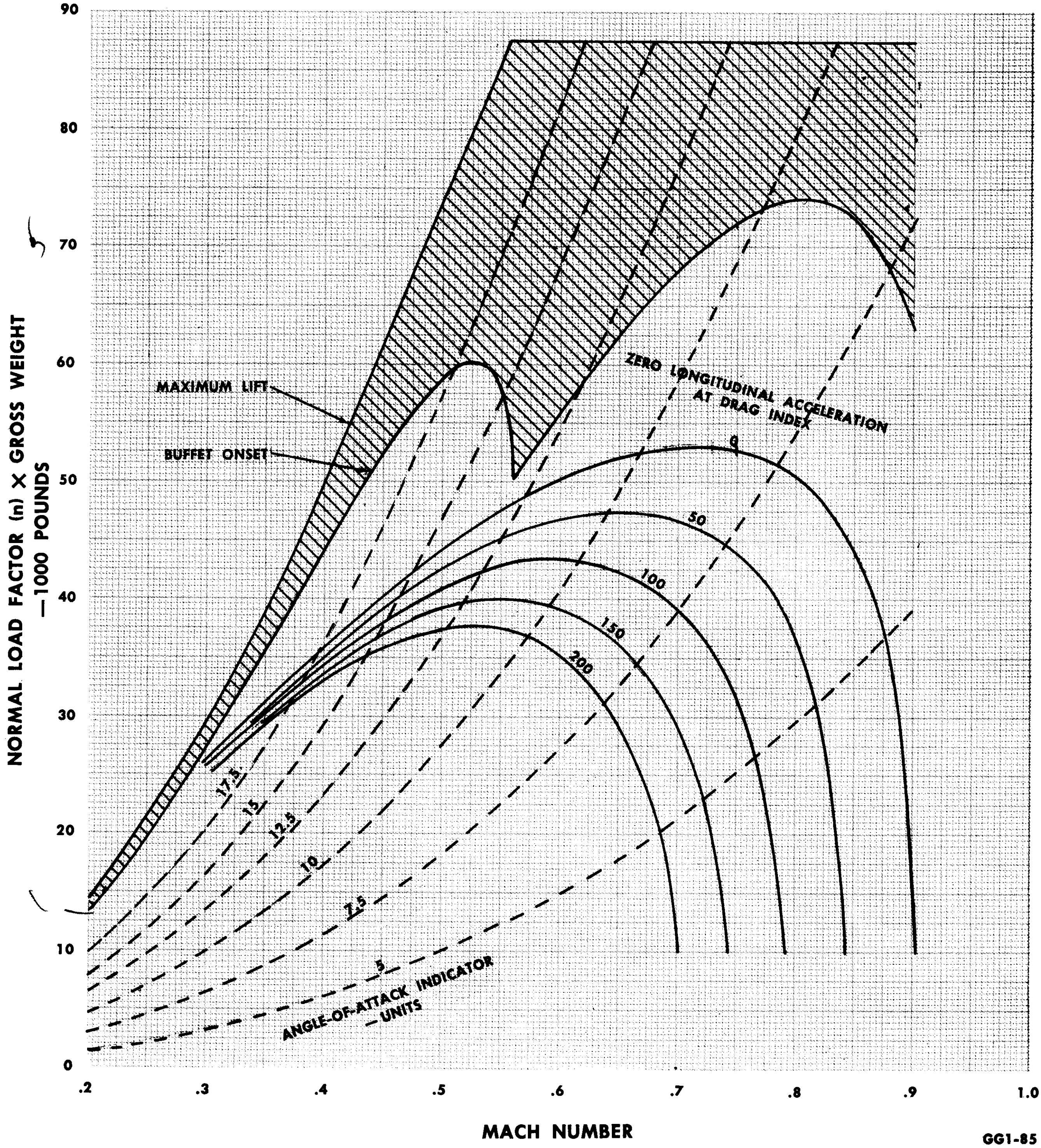
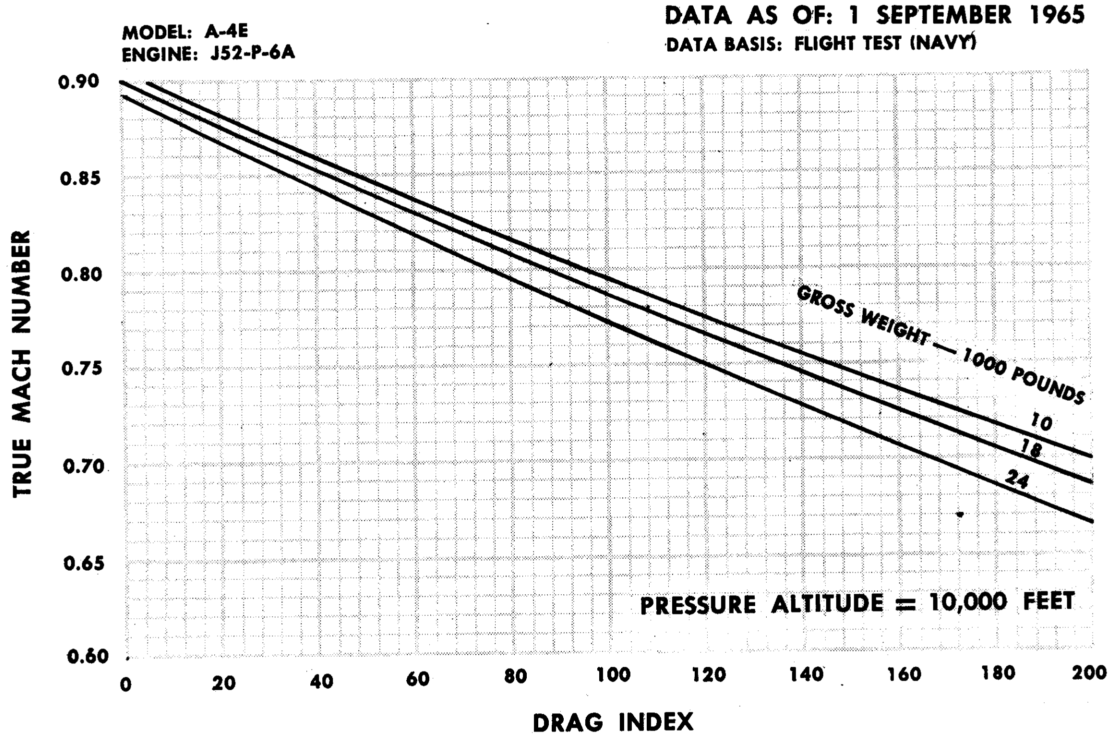


Figure 11-82. Maneuverability (Sheet 2)

MAXIMUM MACH NUMBER

MILITARY THRUST
ICAO STANDARD ATMOSPHERE



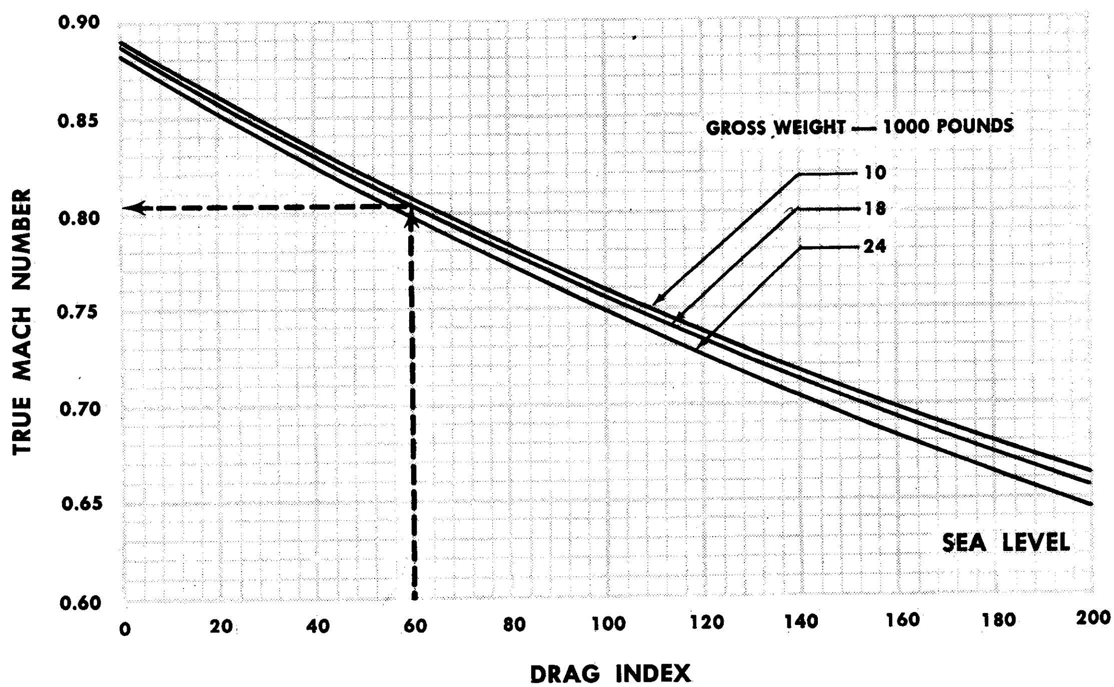


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Figure 11-83. Maximum Mach Number

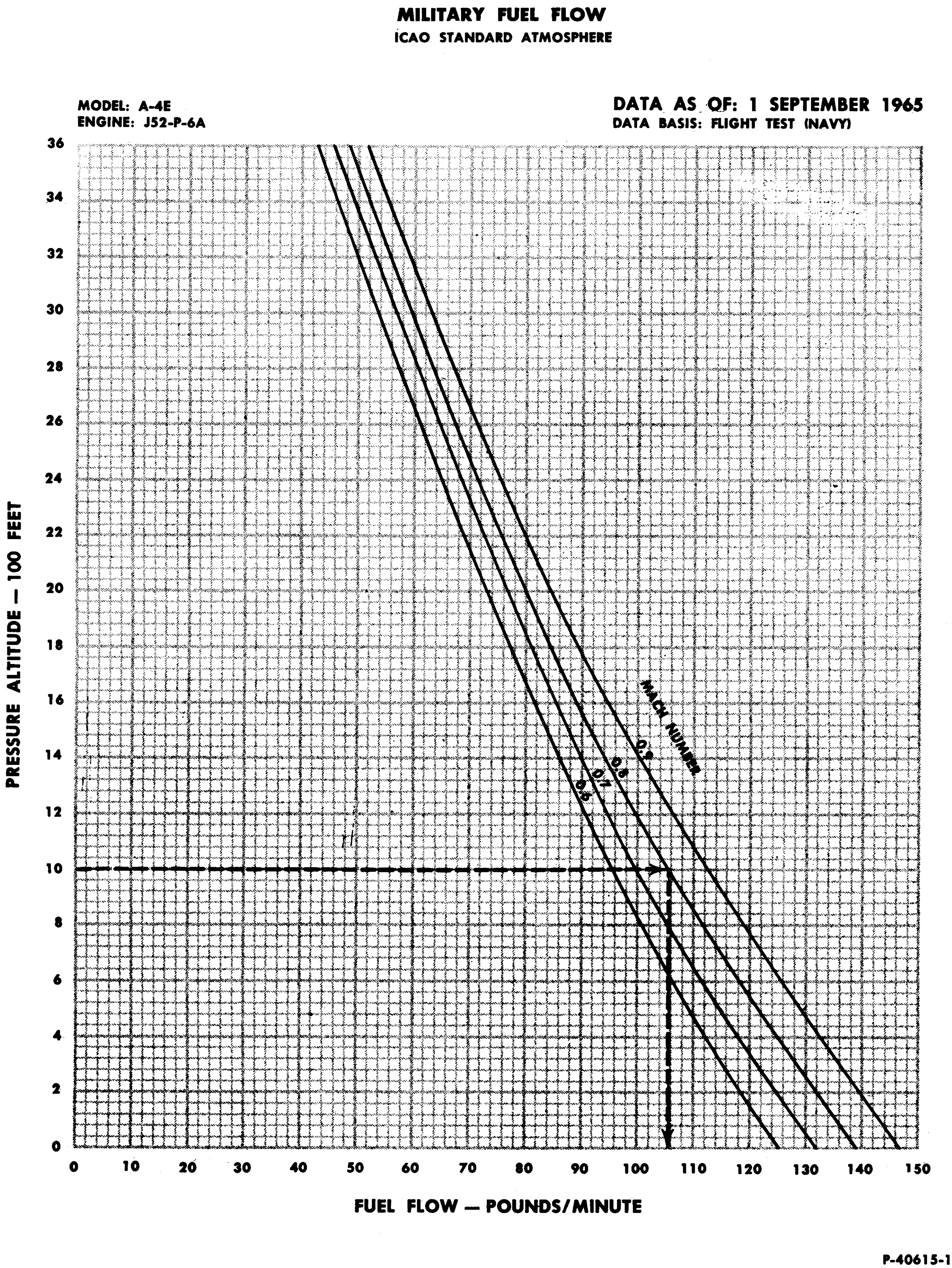

Figure 11-84. Military Fuel Flow

NATOPS FLIGHT MANUAL GLOSSARY

A/A	Air-to-Air Ranging (TACAN)
AAI	All Attitude Indicator
AAR	Aircraft Accident Report
ac	Alternating current
ACC	Air Crew Change
ACP	Aircraft Communications Procedures
ADCS	Air Data Computer Set
ADF	Automatic Direction Finding
ADI	Attitude Director Indicator
ADIZ	Air Defense Identification Zone
ADL	Armament Datum Line
AFC	Automatic Frequency Control
AFCS	Automatic Flight Control System
A/G	Air-to-Ground
agc	Automatic gain control
AGL	Above Ground Level
AI	Airborne Intercept
AJB	Airborne, electro-mechanical, bombing
AMCS	Airborne Missile Control System
AOA	Angle-of-Attack
AOJ	Acquisition On Jam
AP	Autopilot
APC	Approach Power Compensator
APN	Airborne, radar, navigational aid
APQ	Airborne, radar, special purpose
AR	Air Refueling
ARC	Airborne, radio, control
ARTCC	Air Route Traffic Control Center
ASC	Aircraft Service Change
ASQ	Airborne, special type, combination of purposes
ASW	Anti-Submarine Warfare
ATC	Air Traffic Control
AWW	Airborne, armament, control
BDHI	Bearing Distance Heading Indicator
BINGO	Return fuel state
Bolter	Hook down, unintentional touch-and-go (missed wire)
BRC	Base Recovery Course
BRT	Bright
BST	Boresight
Buddy Store	Inflight Refueling Store
Buster	Full military power
CADC	Central Air Data Computer
CAP	Combat Air Patrol
CARQUAL	Carrier Qualifications
CAS	Calibrated Airspeed
CAT	Catapult
CAT	Clear Air Turbulence
CATCC	Carrier Air Traffic Control Center
CCA	Carrier Controlled Approach
CG	Center of Gravity
Charlie Time	Expected time over ramp
CIC	Combat Information Center
CIT	Compressor Inlet Temperature
CNI	Communication Navigation Identification
CO_2	Carbon dioxide
CONOLABS	Conventional Ordnance Low Altitude Bombing System
CORC	Conventional Ordnance Release Computer
COT	Cockpit Orientation Trainer
cps	Cycles per second
CRAW	Carrier Readiness Attack Wing
CSD	Constant Speed Drive
CSS	Control Stick Steering
CVA	Aircraft Carrier (Attack)
CVS	Anti-Submarine Carrier
cw	Continuous Wave
DART	Ejection Seat Stabilization System
dc	Direct current
DCU	Douglas Control Unit
Dead Beat	Causing the object, when disturbed, to return to its original position without oscillation.
Delta	Orbit pattern
DF	Direction Finding
DIRTY	Landing Configuration
DIRTY-UP	Changing to Landing Configuration
DME	Distance Measuring Equipment
Dog Radial	An assigned radial on which to set up a holding pattern
DONUT	Optimum approach index
DR	Dead Reckoning
D-ring/ handle	Manual Ripcord Handle
EAC	Estimated Approach Clearance
EAS	Equivalent Airspeed
EAT	Estimated Approach Time
ECCM	Electronic Counter-Countermeasure(s)
ECM	Electronic Countermeasure(s)
EGT	Exhaust Gas Temperature
EMERG	Emergency
EPI	Engine Performance Indicator
EPR	Engine Pressure Ratio
EXT	Exterior/External
FAM	Familiarization
FL	Flight Level
FLIP	Flight Information Publication
FCLP	Field Carrier Landing Practice
Foxtrot Corpen	Fleet Course
fpm	Feet per minute
FUS	Fuselage
FWD	Forward
g's	Gravity
GAL	Gallon
Gate	Maximum Power
GCA	Ground Control Approach
GCBS	Ground Control Bombing System
GCI	Ground Control Intercept
gpm	Gallon per minute
GTC	Ground Turbine Compressor
Hangfire	A delay or failure of an article of ordnance after being triggered
HDG SEL	Heading Selector Switch
HI	High
HMI	Handbook of Maintenance Instructions

Hot Start	A start that exceeds normal starting temperatures
HPA	High Precautionary Approach
HYD	Hydraulic
IAS	Indicated Airspeed
IFF	Identification Friend or Foe
IFR	Instrument Flight Rules or In Flight Refueling
ILS	Instrument Landing System
IMN	Indicated Mach Number
IMP	Imperial
INST	Instrument
INT	Interior
IP	Identification Point
I/P	Identification of Position
IR	Infrared
JANAP	Joint Army Navy Airforce Publication
JATO	Jet Assist Takeoff
JETT	Jettison
JP	Jet Propulsion
Judy	Radar contact with target, taking over intercept
kt/kn	Knots
LABS	Low Altitude Bombing System
LAWS	Low Altitude Warning System
LDG GR	Landing Gear
LE	Leading Edge
LO	Low
LOX	Liquid Oxygen
LPA	Low Precautionary Approach
lpm	Liters per minute
LSO	Landing Signal Officer (Paddles)
LTS	Lights
MAC	Mean Aerodynamic Chord
MAN	Manual
MARSHAL	Carrier Controlled Approach Holding
MAX	Maximum
MBR	Multiple Bomb Rack
Meatball	Glide slope image of mirror landing system
MER	Multiple Ejector Rack
MIL	Military
MIM	Maintenance Instruction Manual
MIN	Minimum
MIN	Minute
Misfire	A permanent failure of an article of ordnance being triggered.
MK	Mark
MLP	Mirror Landing Practice
MOD	Modification
MSL	Mean Sea Level
NAMT	Naval Air Maintenance Training
NAMTD	Naval Air Maintenance Training Detachment
NATO	North Atlantic Treaty Organization
NATOPS	Naval Air Training and Operating Procedures Standardization
NAVAIDS	Navigation Aids
NAVPAC	Navigation Package
NMPP	Nautical Miles Per Pound
NTDS	Naval Tactical Data System
NWIP	Naval Warfare Information Publication
NWIP	Naval Warfare Intercept Procedures
NWP	Naval Warfare Publication
OAT	Outside Air Temperature
OBST	Obstruction
OFT	Operational Flight Trainer
OMNI	Omni Directional Range
PA	Power Approach
Paddles	Landing Signal Officer
PAR	Periodic Aircraft Rework
PAR	Precision Approach Radar
PC	Power Control
Pigeons	Bearing and Distance
PK	Pararaft Kit
P/C	Plane Captain
Platform	The 5000 ft altitude level in a CCA
PMBR	Practice Multiple Bomb Rack
PoGo	Return to last or assigned radio frequency
PPC	Power Plants Change
PPH	Pounds Per Hour
PPS	Pulses Per Seconds
prf	Pulse repetition frequency
PRIM	Primary
psi	Pounds per square inch
PTT	Press-to-test
q	Dynamic Pressure, psf
Qt	Quart
RADAR	Radio Detection and Ranging
RAT	Ram Air Turbine
RATCC	Radar Air Traffic Control Center
RCR	Runway Condition Reading
RDO	Runway Duty Officer
RET	Retracted
rf	Radio Frequency
RF	Reconnaissance – Fighter
RMI	Radio Magnetic Indicator
ROD	Rate of Descent
rpm	Revolution per minute
SAR	Sea Air Rescue
SAR	Surveillance Approach Radar
SEC	Second
SEC	Secondary
S/B	Speedbrake
SID	Standard Instrument Departure
SIF	Selective Identification Feature
SPD BRK	Speedbrake
SPEC	Specification
SRCH	Search
SRT	Standard Rate Turn
STA	Station
STAB AUG	Stability Augmentation
SYNC	Synchronize
TACAN	Tactical Air Navigation
TAS	True Airspeed
T/C	Terrain Clearance
TE	Trailing Edge
TER	Triple Ejector Rack

THRU	Through
TMN	True Mach Number
TRA	Transfer
TRANS	Transfer
Trap	Arrested Landing
UHF	Ultra High Frequency
US	United States
VFR	Visual Flight Rules
VHF	Very High Frequency
Vn	Velocity Acceleration Relationship
VORTAC	Very High Frequency – Omni Range and Tactical Air Navigation
Vs	Versus
W	With
W/O	Without
WST	Weapons System Trainer
Yellow Sheet	Naval Aircraft Discrepancy Record
ZDL	Zero Delay Lanyard

ALPHABETICAL INDEX

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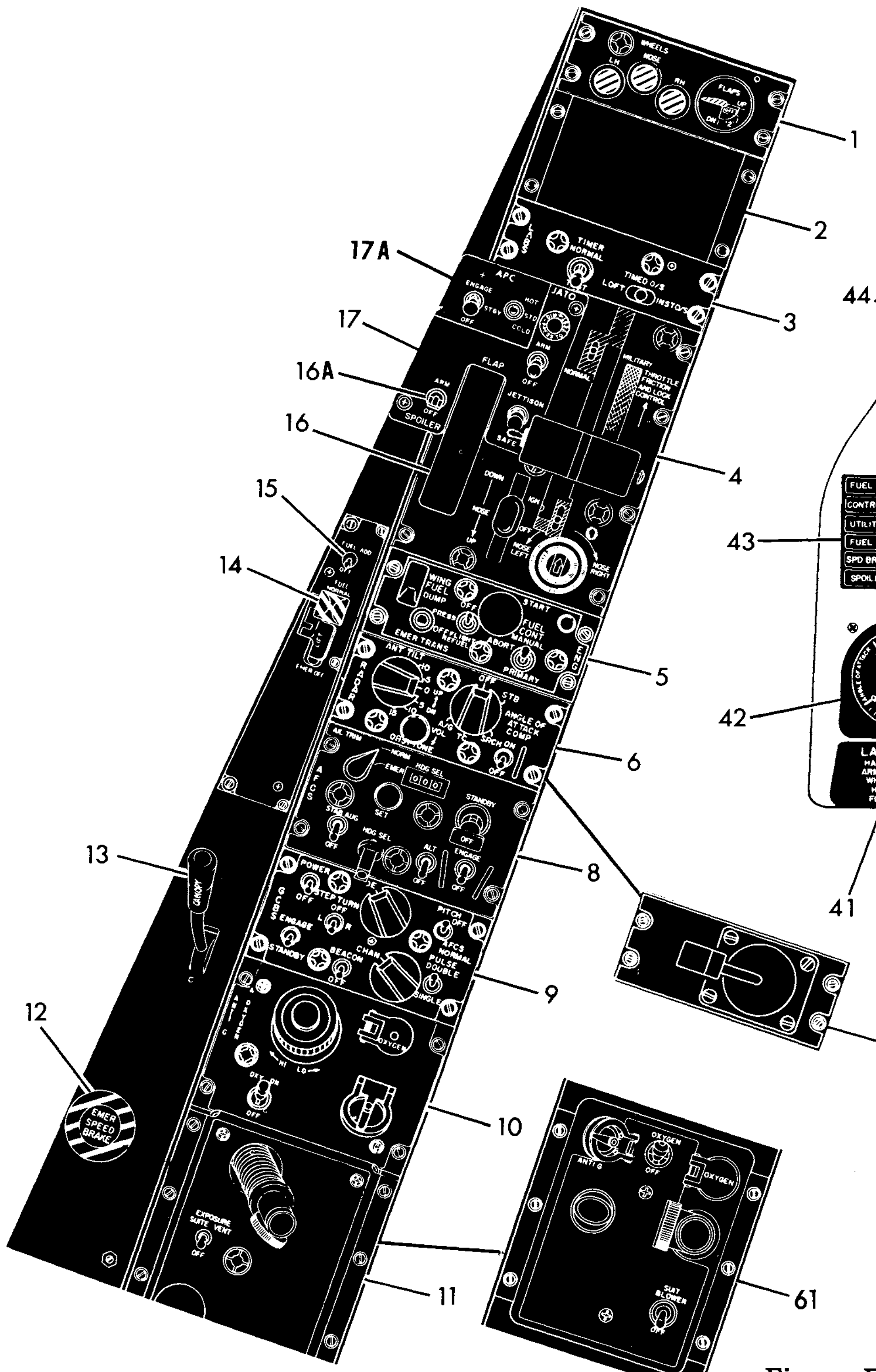
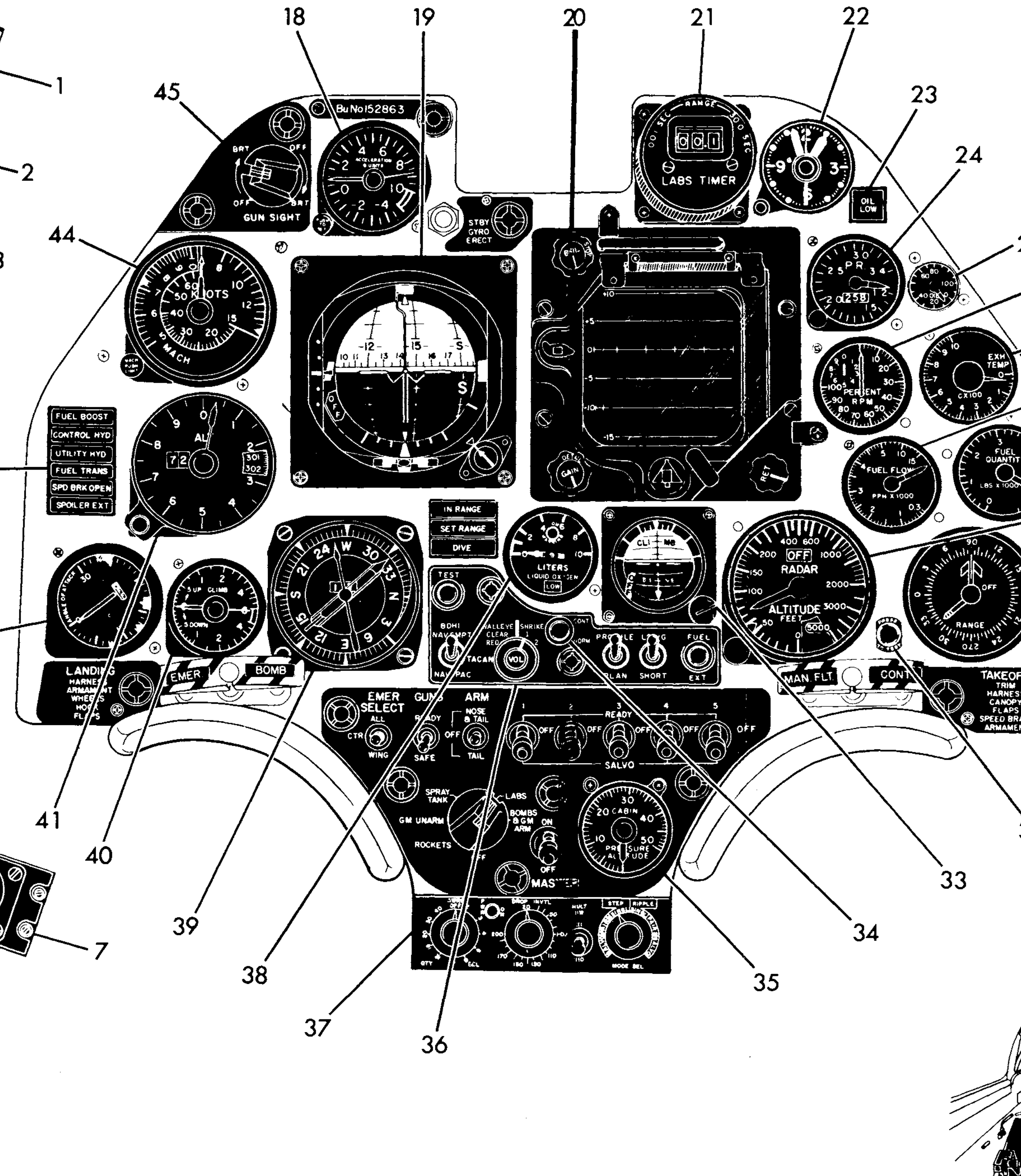
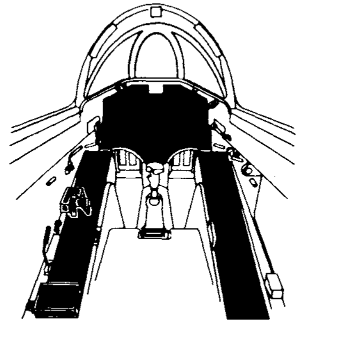
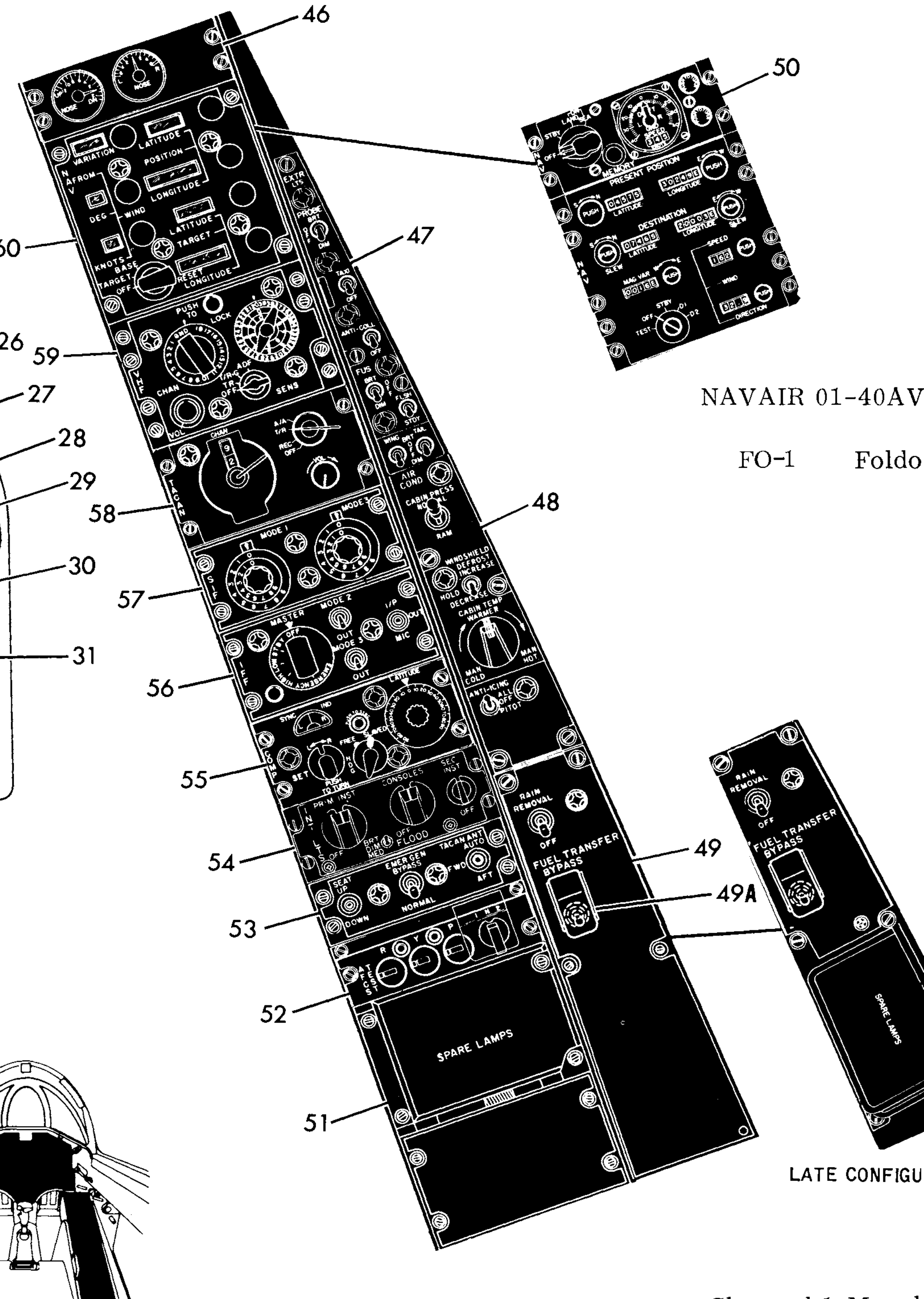


A-4 AFC 387







LATE CONFIGURATION

Figure FO-1. A-4E Cockpit – Typical Left, Instrument, and Right Panels

1. WHEELS AND FLAPS PANEL
2. BLANK PANELS (NOT REWORKED PER A-4 AFC 376) WEAPON CONTROL PANEL (REWORKED PER A-4 AFC 376)
3. LABS CONTROL PANEL (NOT REWORKED PER A-4 AFC 376) BLANK PANEL (REWORKED PER A-4 AFC 376)
4. THROTTLE PANEL
5. ENGINE CONTROL PANEL
6. RADAR CONTROL PANEL (NOT REWORKED PER A-4 AFC 256 OR REWORKED PER A-4 AFC 387)
7. ARN-77 CONTROL SELECTOR (REWORKED PER A-4 AFC 256)
8. AFCS PANEL
9. GCBS PANEL
10. OXYGEN AND ANTI-G PANEL
11. ANTIEXPOSURE SUIT CONTROL PANEL
12. EMERGENCY SPEEDBRAKE CONTROL
13. CANOPY CONTROL HANDLE
14. MANUAL FUEL SHUTOFF CONTROL LEVER
15. SMOKE ABATEMENT SWITCH
16. FLAP HANDLE
16A SPOILER ARM SWITCH
17. JATO CONTROL PANEL
17A APPROACH POWER COMPENSATOR CONTROL PANEL
18. ACCELEROMETER
19. ALL-ATTITUDE INDICATOR
20. RADAR SCOPE
21. LABS TIMER
22. 8-DAY CLOCK
23. OIL QUANTITY INDICATOR SWITCH (LATE A-4E)
24. PRESSURE RATIO INDICATOR
25. OIL PRESSURE INDICATOR
26. TACHOMETER
27. EXHAUST GAS TEMPERATURE INDICATOR
28. FUEL FLOW INDICATOR
29. FUEL QUANTITY INDICATOR
30. RADAR ALTIMETER
31. DEAD RECKONING INDICATOR (EARLY A-4E)
32. RADAR ALTIMETER LOW-LIMIT WARNING LIGHT
33. STANDBY ATTITUDE INDICATOR
34. SIDS CONT-NORM MODE SWITCH
35. ARMAMENT PANEL
36. MISCELLANEOUS SWITCHES PANEL
37. AIRCRAFT WEAPONS RELEASE SYSTEM PANEL (LATE A-4E)
38. OXYGEN QUANTITY INDICATOR
39. BEARING-DISTANCE-HEADING INDICATOR
40. VERTICAL SPEED INDICATOR
41. ALTIMETER
42. ANGLE-OF-ATTACK INDICATOR
43. CAUTION PANEL (LADDER LIGHTS)
44. AIRSPEED INDICATOR
45. GUNSIGHT PANEL
46. TRIM POSITION INDICATOR PANEL
47. EXTERIOR LIGHTS PANEL
48. AIR CONDITIONING PANEL
49. RAIN REMOVAL PANEL
49A FUEL TRANSFER BYPASS SWITCH
50. DOPPLER NAVIGATIONAL COMPUTER (ASN-41)(LATE A-4E)
51. SPARE LAMPS CONTAINER (NOT REWORKED PER A-4 AFC 256) AFCS TEST SWITCH PANEL (REWORKED PER A-4 AFC 256)
52. AFCS TEST SWITCH PANEL (NOT REWORKED PER AFC 256) COMPASS CONTROL PANEL (REWORKED PER A-4 AFC 256)
53. MISCELLANEOUS SWITCHES PANEL
54. INTERIOR LIGHTS PANEL (REWORKED PER A-4 AFC 428)
55. COMPASS CONTROL PANEL (NOT REWORKED PER A-4 AFC 256) IFF CONTROL PANEL (REWORKED PER A-4 AFC 256)
56. IFF CONTROL PANEL (NOT REWORKED PER A-4 AFC 256) RADAR CONTROL PANEL (REWORKED PER A-4 AFC 256) AN/APR-25 (V) CONTROL PANEL (REWORKED PER A-4 AFC 394)
57. SIF CONTROL PANEL
58. TACAN CONTROL PANEL
59. UHF CONTROL PANEL
60. NAV CONTROL PANEL (ASN-19, EARLY A-4E)
61. OXYGEN, ANTI-G, AND ANTIEXPOSURE SUIT CONTROL PANEL (REWORKED PER A-4 AFC 387)

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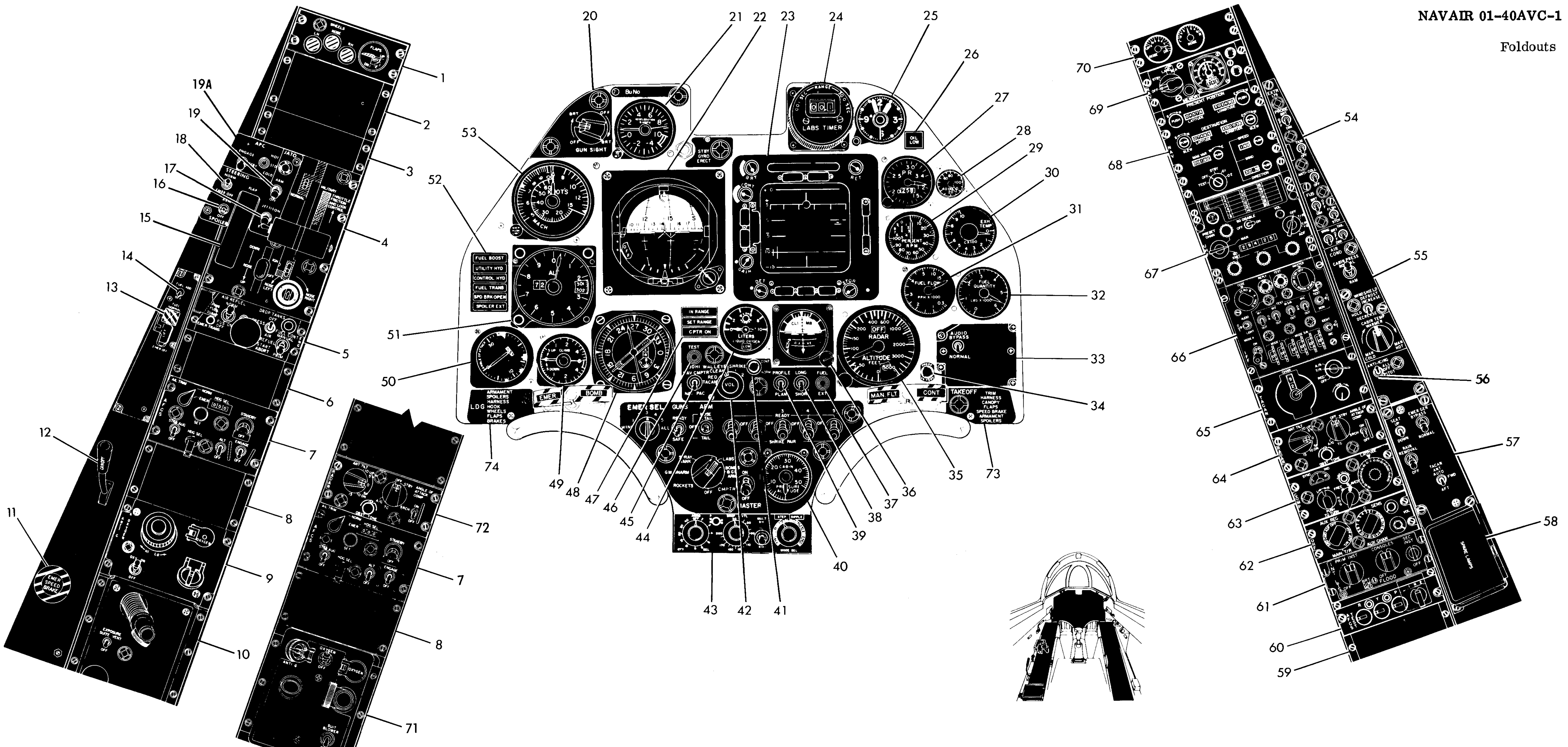
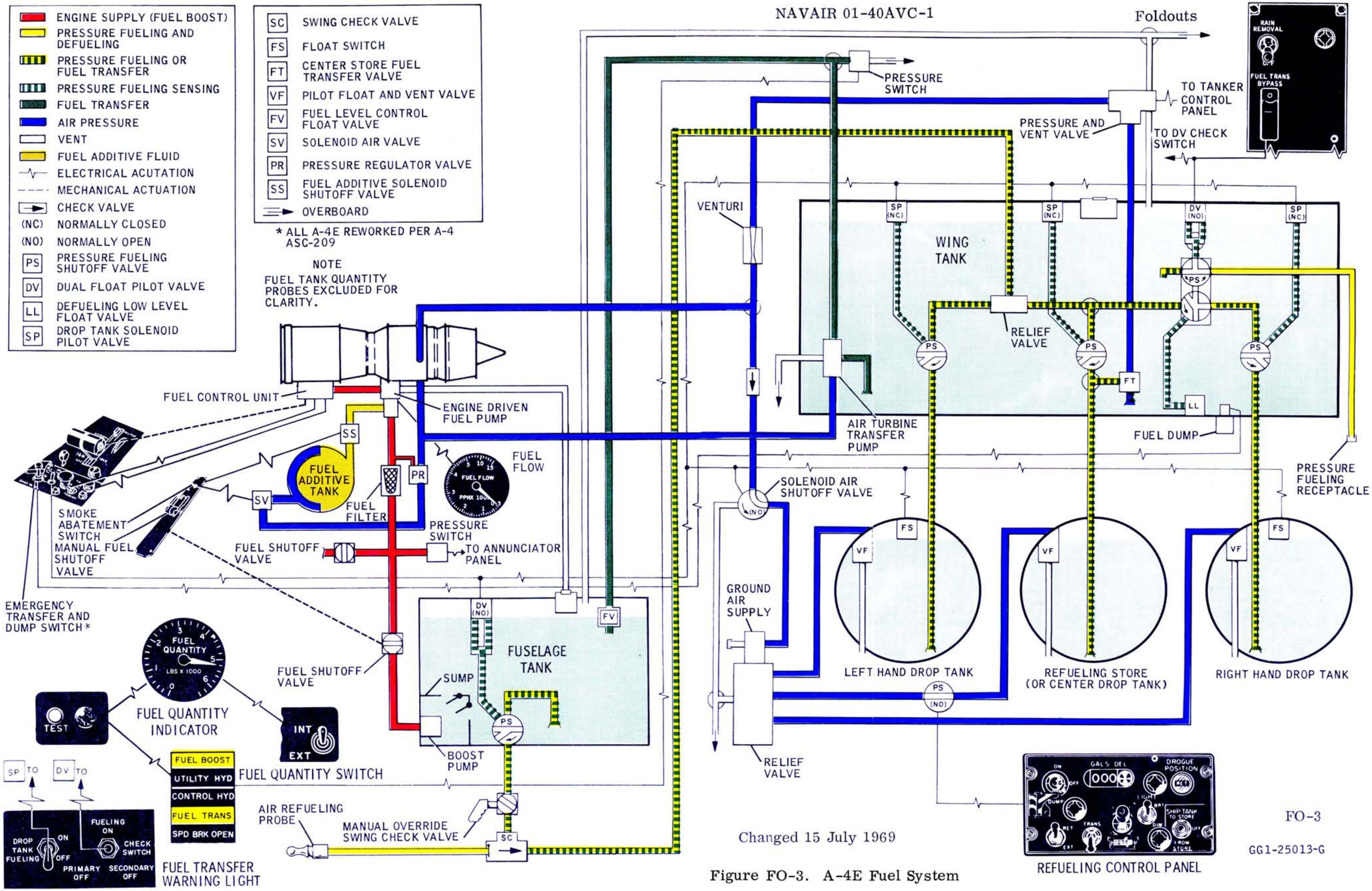


Figure FO-2. A-4F Cockpit – Typical Left, Instrument, and Right Panels

1. WHEELS AND FLAPS POSITION INDICATOR PANEL
2. BLANK PANEL
3. BLANK PANEL
4. THROTTLE PANEL
5. ENGINE CONTROL PANEL
6. BLANK PANEL
7. AUTOPILOT CONTROL PANEL
8. BLANK PANEL
9. OXYGEN AND ANTI-G PANEL
10. ANTIEXPOSURE SUIT CONTROL PANEL
11. EMERGENCY SPEEDBRAKE CONTROL
12. CANOPY CONTROL HANDLE
13. MANUAL FUEL SHUTOFF CONTROL LEVER
14. SMOKE ABATEMENT SWITCH
15. FLAP HANDLE
16. SPOILER ARM SWITCH
17. JATO JETTISON SWITCH
18. NOSEWHEEL STEERING SWITCH
19. JATO ARM SWITCH
19A. APPROACH POWER COMPENSATOR CONTROL PANEL
20. GUNSIGHT PANEL
21. ACCELEROMETER
22. ALL-ATTITUDE INDICATOR
23. RADAR SCOPE
24. LABS TIMER
25. 8-DAY CLOCK
26. OIL QUANTITY INDICATOR/SWITCH
27. PRESSURE RATIO INDICATOR
28. OIL PRESSURE INDICATOR
29. TACHOMETER
30. EXHAUST GAS TEMPERATURE INDICATOR
31. FUEL FLOW INDICATOR
32. FUEL QUANTITY INDICATOR
33. AUDIO BYPASS SWITCH PANEL
34. RADAR ALTIMETER LOW LIMIT WARNING LIGHT
35. RADAR ALTIMETER
36. STANDBY ATTITUDE INDICATOR
37. FUEL INT-EXT SWITCH
38. RADAR LONG-SHORT SWITCH
39. RADAR PROFILE-PLAN SWITCH
40. ARMAMENT CONTROL PANEL
41. TARGET REJECT SWITCH
42. SHRIKE VOLUME SWITCH
43. AIRCRAFT WEAPONS RELEASE SYSTEM PANEL
44. LIQUID OXYGEN QUANTITY INDICATOR
45. BDHI, NAV COMPUTER TACAN-NAVPAC SWITCH
46. TEST SWITCH
47. PILOT ADVISORY LIGHTS (REWORKED PER A-4 AFC 465)
48. BEARING-DISTANCE-HEADING INDICATOR
49. VERTICAL SPEED INDICATOR
50. ANGLE-OF-ATTACK INDICATOR
51. ALTIMETER
52. CAUTION PANEL (LADDER LIGHTS)
53. AIRSPEED INDICATOR
54. EXTERIOR LIGHTS PANEL
55. AIR CONDITIONING PANEL
56. ANTI-ICING SWITCH
57. MISCELLANEOUS SWITCHES PANEL
58. SPARE LAMP CONTAINER
59. BLANK PANEL
60. AFCS TEST PANEL
61. INTERIOR LIGHTS PANEL (REWORKED PER A-4 AFC 428)
62. AUXILIARY UHF CONTROL PANEL
63. COMPASS CONTROL PANEL
64. RADAR CONTROL PANEL (NOT REWORKED PER A-4 AFC 387) AN/APR-25 (V) CONTROL PANEL (REWORKED PER A-4 AFC 394)
65. TACAN CONTROL PANEL
66. IFF CONTROL PANEL
67. UHF CONTROL PANEL
68. NAVIGATION COMPUTER CONTROL PANEL
69. DOPPLER RADAR CONTROL PANEL
70. TRIM POSITION INDICATOR PANEL
71. OXYGEN, ANTI-G, AND ANTIEXPOSURE SUIT CONTROL PANEL (REWORKED PER A-4 AFC 387)
72. RADAR CONTROL PANEL (REWORKED PER A-4 AFC 387)
73. TAKEOFF CHECKLIST
74. LANDING CHECKLIST (REWORKED PER A-4 AFC 430)

GG-17-D

Foldouts



Changed 15 July 1969

Figure FO-3. A-4E Fuel System

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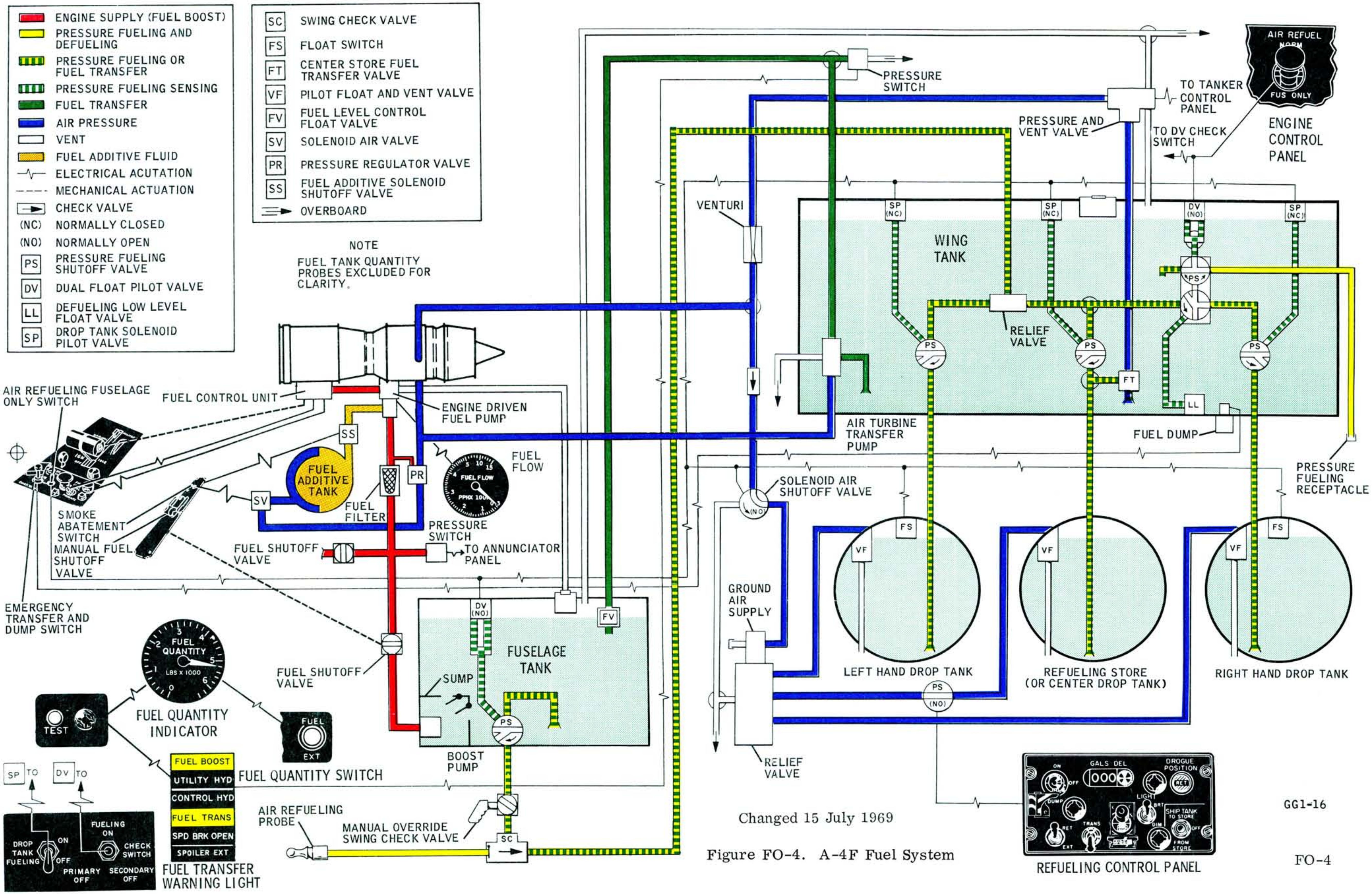

Changed 15 July 1969

Figure FO-4. A-4F Fuel System

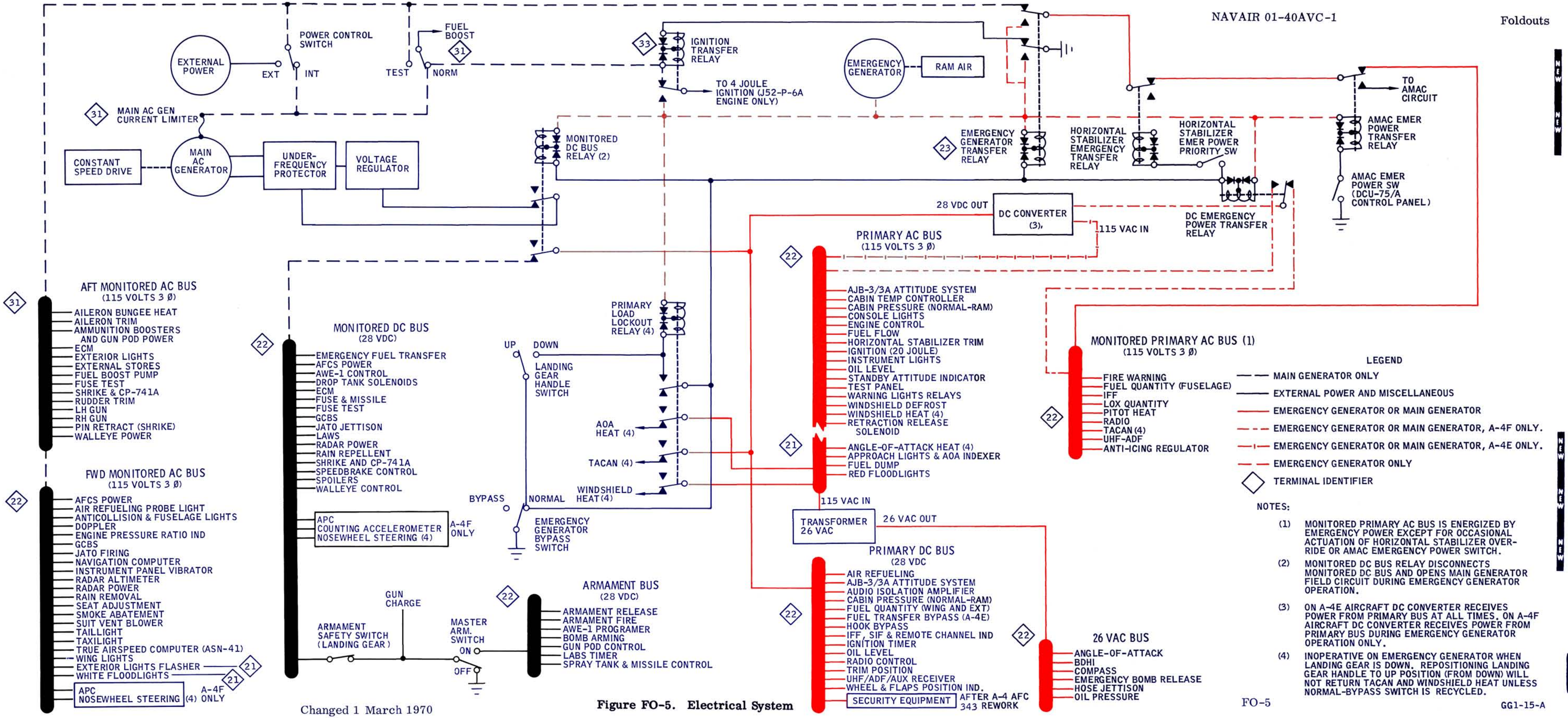

Figure FO-5. Electrical System

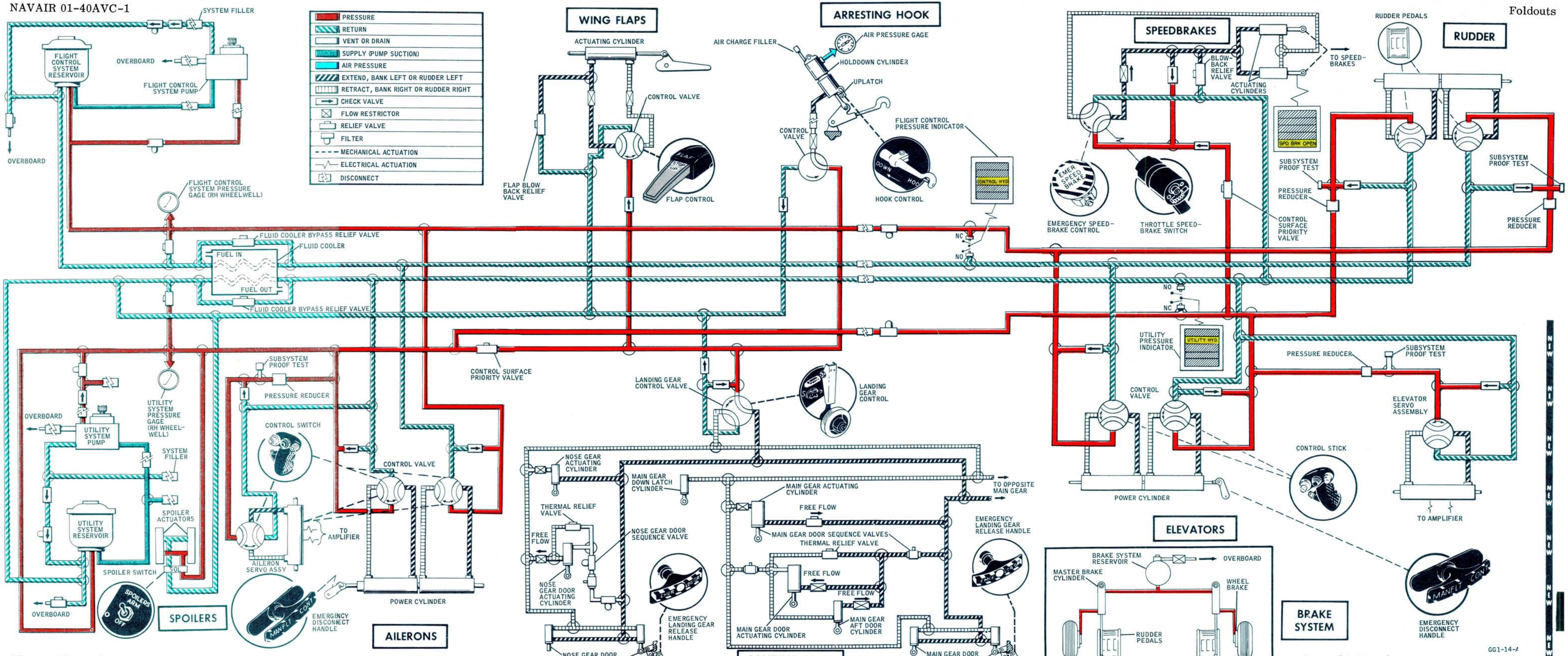

Figure FO-6. A-4E Hydraulic System

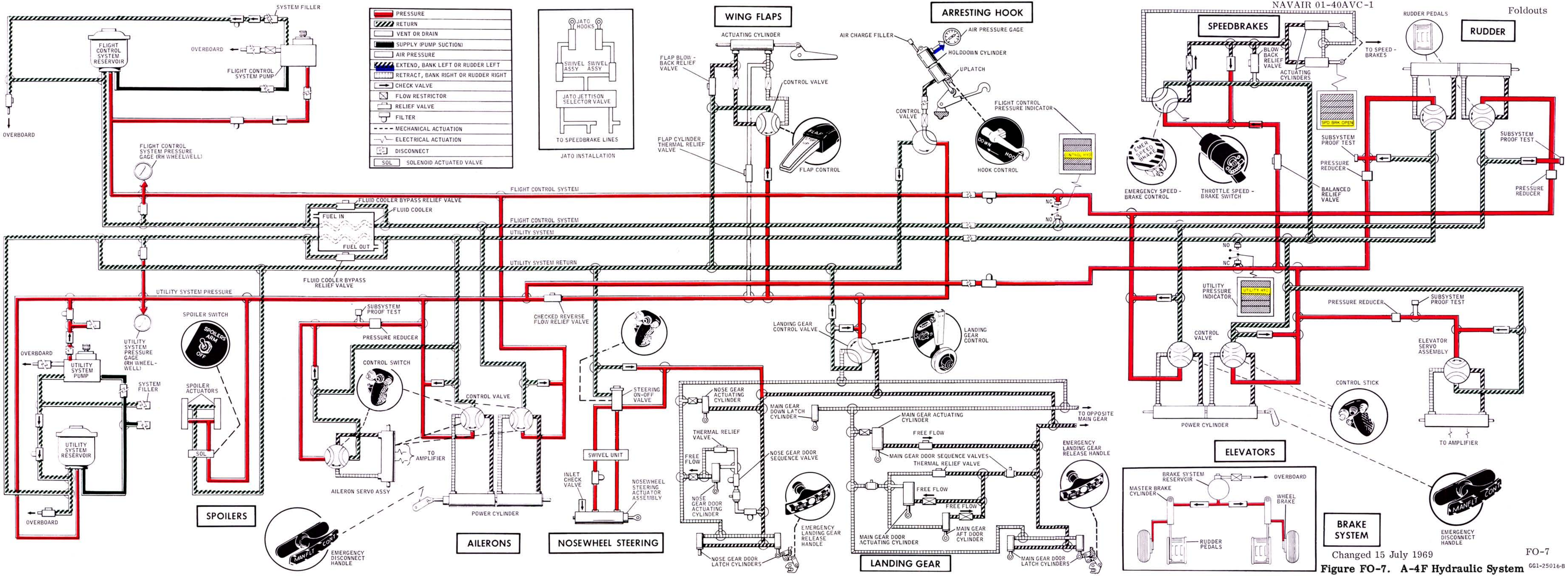

Figure FO-7. A-4F Hydraulic System

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